

Technical training. Product information.

F12 General Vehicle Electronics



BMW Service

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General information

Symbols used

The following symbol is used in this document to facilitate better comprehension or to draw attention to very important information:



Contains important safety information and information that needs to be observed strictly in order to guarantee the smooth operation of the system.

Information status and national-market versions

BMW Group vehicles meet the requirements of the highest safety and quality standards. Changes in requirements for environmental protection, customer benefits and design render necessary continuous development of systems and components. Consequently, there may be discrepancies between the contents of this document and the vehicles available in the training course.

This document basically relates to the European version of left hand drive vehicles. Some operating elements or components are arranged differently in right-hand drive vehicles than shown in the graphics in this document. Further differences may arise as the result of the equipment specification in specific markets or countries.

Additional sources of information

Further information on the individual topics can be found in the following:

- Owner's Handbook
- Integrated Service Technical Application.

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The information contained in this document forms an integral part of the technical training of the BMW Group and is intended for the trainer and participants in the seminar. Refer to the latest relevant information systems of the BMW Group for any changes/additions to the technical data.

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VH-23/International Technical Training

F12 General Vehicle Electronics

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1. Introduction

The vehicle electrical system of the F12 is based extensively on current BMW models. This training material provides an overview of the most important topics relevant to the vehicle electrical system.

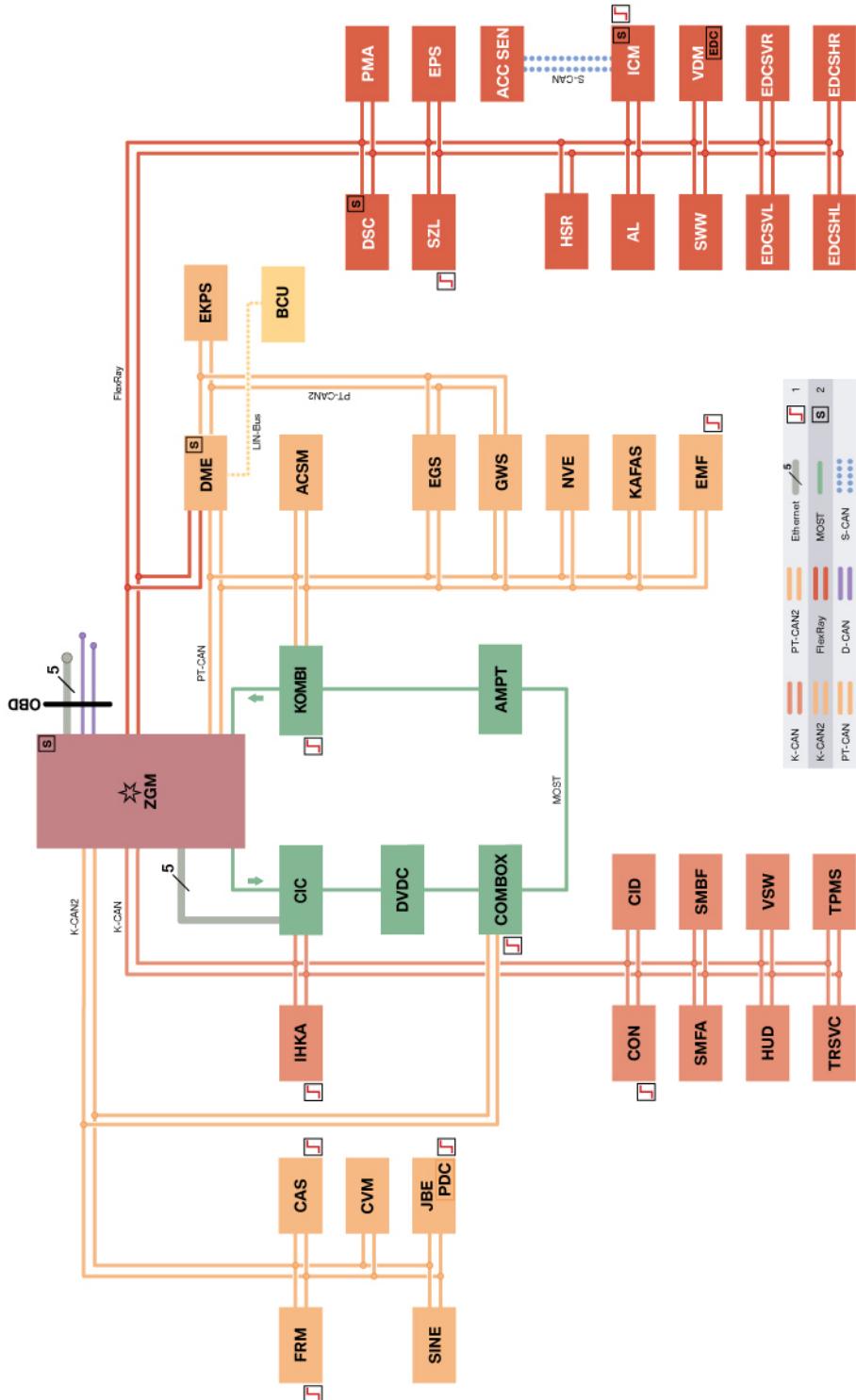
For more information on the various topics, refer to the F01/F02 documentation.

F12 topic	F01/F02 training material
Voltage supply	F01/F02 voltage supply
Car Access System	F01/F02 Car Access System.
Comfort Access	F01/F02 Comfort Access
Central locking system	F01/F02 central locking system
Power window regulator	F01/F02 power window regulator
Alarm system	F01/F02 alarm system
Exterior lights	F01/F02 exterior lights
Interior light	F01/F02 interior lighting.

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2. Vehicle electrical system

2.1. Bus overview



F12 Bus overview

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2. Vehicle electrical system

Index	Explanation
1	Control units with wake-up authorization
2	Start-up node control units for starting up and synchronizing the FlexRay bus system
ACC-SEN	Active Cruise Control Sensor
ACSM	Advanced Crash Safety Module
AL	Active steering
AMPT	Top HiFi amplifier
BCU	Battery Charge Unit (for auxiliary battery only w/IAC)
CAS	Car Access System
CID	Central information display
COMBOX	Combox (Combox multimedia, Combox multimedia with telematics)
CON	Controller
CVM	Convertible top module
DME	Digital Motor Electronics
DSC	Dynamic Stability Control
DVDC	DVD changer
EDCSHL	Electronic Damper Control satellite, rear left
EDCSHR	Electronic Damper Control satellite, rear right
EDCSVL	Electronic Damper Control satellite, front left
EDCSVR	Electronic Damper Control satellite, front right
EGS	Electronic transmission control
EKPS	Electronic fuel pump control
EMF	Electromechanical parking brake
EPS	Electronic power steering (electromechanical power steering)
FRM	Footwell module
GWS	Gear selector switch
HEADUNIT	Headunit (car information computer or car information computer basic II)
HSR	Rear axle slip angle control
HUD	Head-Up Display
ICM	Integrated Chassis Management
IHKA	Automatic integrated heating and A/C control unit
JBE	Junction box electronics
KAFAS	Camera-based driver support systems
KOMBI	Instrument panel
NVE	Night vision electronics

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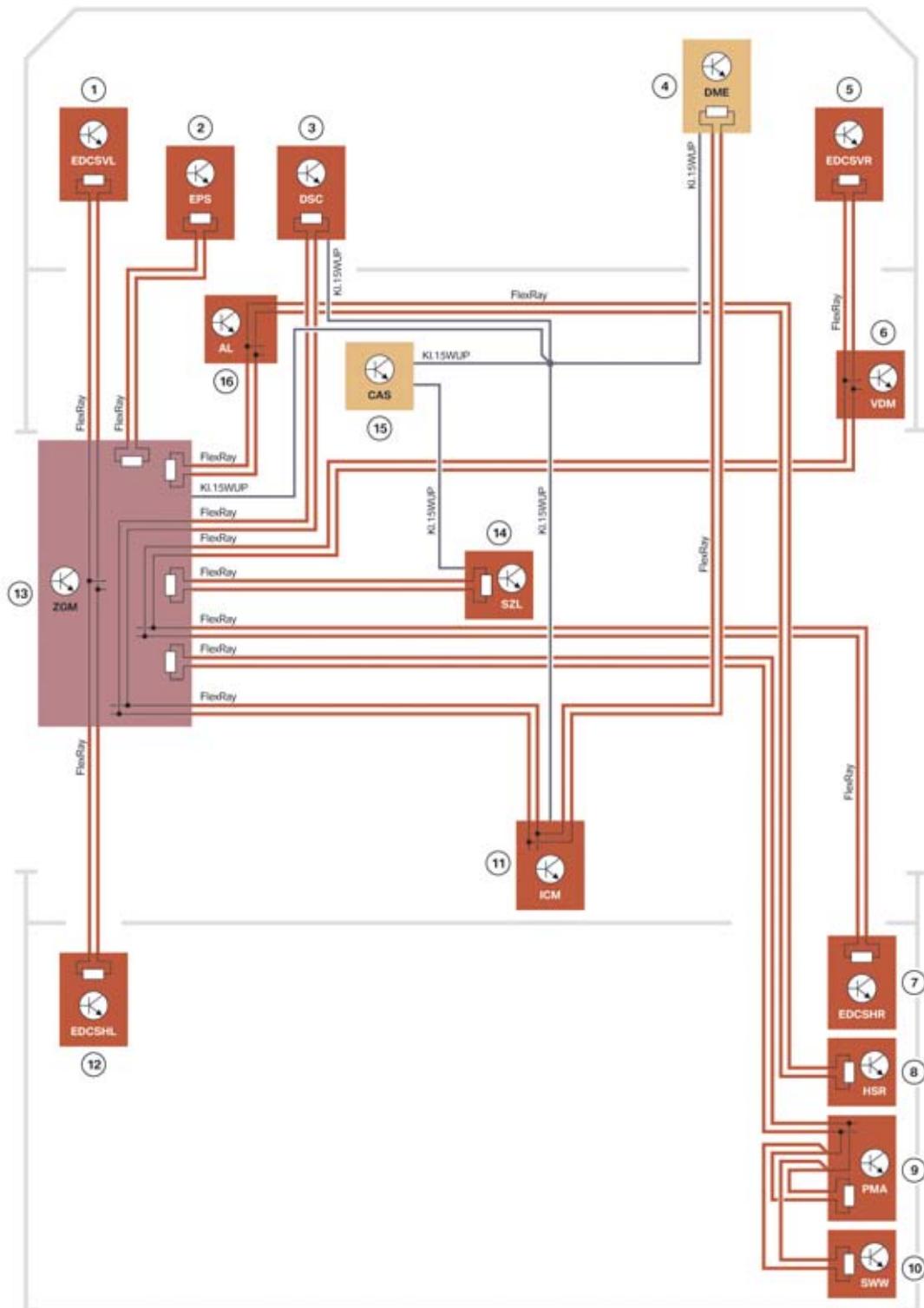
2. Vehicle electrical system

Index	Explanation
PDC	Park Distance Control
PMA	Parking manoeuvring assistant
TPMS	Tire Pressure Monitor System
SINE	Siren with tilt alarm sensor
SMBF	Front passenger seat module
SMFA	Driver's seat module
SWW	Blind Spot Detection (Lane change warning)
SZL	Steering column switch cluster
TRSVC	Control unit for camera systems
VDM	Vertical Dynamics Management
VSW	Video switch
ZGM	Central gateway module

The FlexRay is shown in a simplified form in the overview of the bus systems. The following system wiring diagram shows the actual physical layout (topology).

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2. Vehicle electrical system



F12 FlexRay system wiring diagram

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2. Vehicle electrical system

Index	Explanation
1	Electronic Damper Control satellite, front left
2	Electric Power Steering (EPS)
3	Dynamic Stability Control (DSC)
4	Digital Motor Electronics (DME)
5	Electronic Damper Control satellite, front right
6	Vertical Dynamics Management (VDM)
7	Electronic Damper Control satellite, rear right
8	Rear axle slip angle control (HSR)
9	Parking assistant (PMA)
10	Blind Spot Detection (SWW)
11	Integrated Chassis Management (ICM)
12	Electronic Damper Control satellite, rear left
13	Central gateway module (ZGM)
14	Steering column switch cluster (SZL)
15	Car Access System (CAS)
16	Active steering (AL)
Terminal 15WUP	Wake-up with terminal 15 ON

2.2. Special features

The vehicle electrical system of the F12 is based on the F01 (vehicle electrical system NB2020).

FlexRay is also used in the F12 as the system bus for networking of the systems that control the dynamic handling characteristics and engine control. The central gateway module ZGM contains two star couplers with eight bus drivers. The bus drivers forward the data of the control units via the communication controller to the central gateway module (ZGM). The FlexRay control units are connected to these bus drivers.

To avoid reflections on the lines, both ends of the data lines are terminated with resistors.

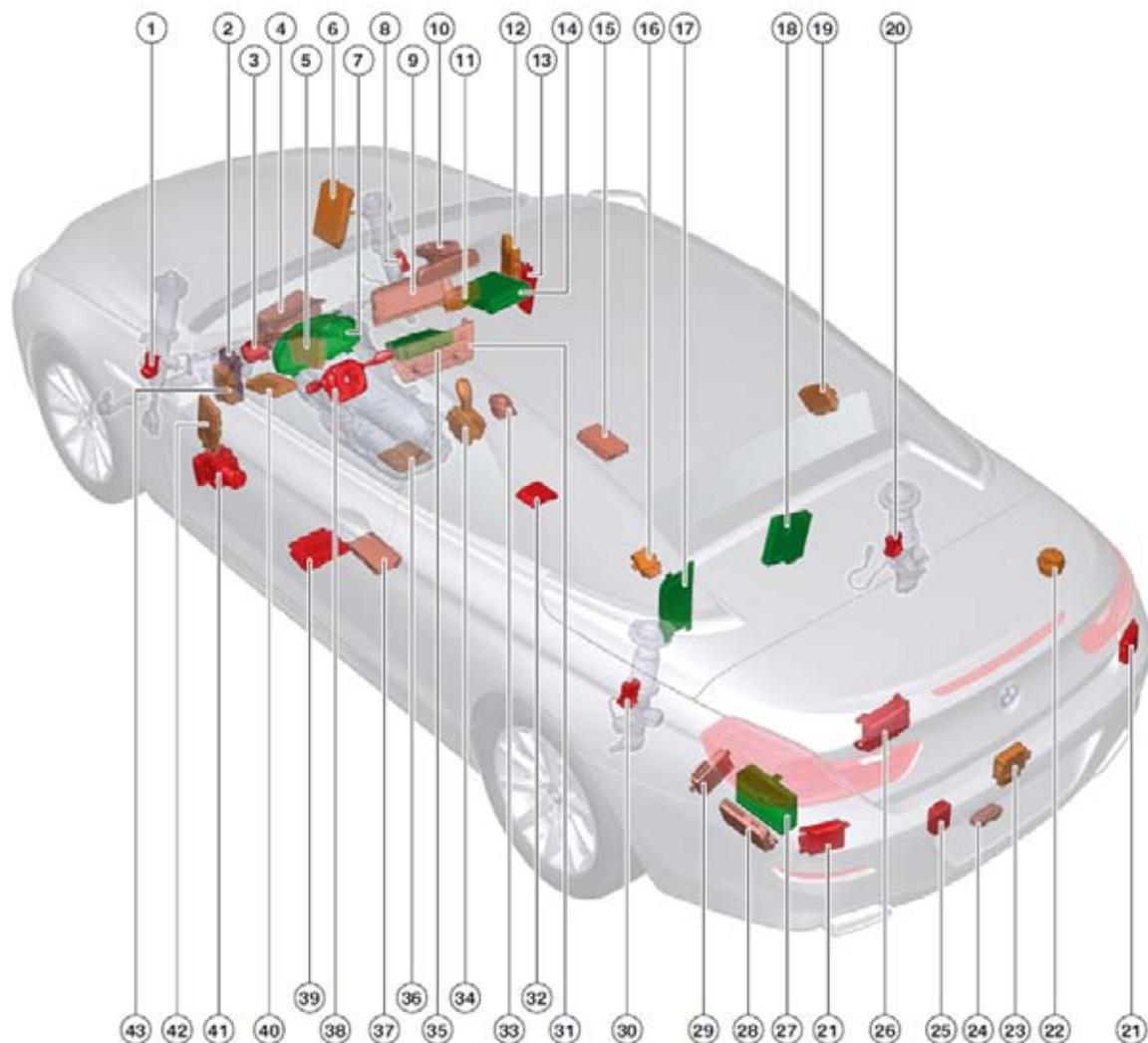
The F12 has Ethernet access in order to be able to program the complete vehicle quickly. It has been possible to discontinue access via the Media Oriented System Transport bus system for programming purposes thanks to the extremely high data transfer rate of the Ethernet (100 MBit/s).

The body controller area network 2 (K-CAN2) facilitates communication between control units with a high data transfer rate (500 kBit/s). The K-CAN2 is also connected to the other bus systems via the central gateway module (ZGM).

The Powertrain Controller Area Network 2 (PT-CAN2) serves as a redundant system for the Powertrain Controller Area Network (PT-CAN) in the area of engine and transmission control unit and also to forward signals to the electric fuel pump.

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2. Vehicle electrical system



F12 component locations

Index	Explanation
1	Electronic Damper Control satellite, front left (EDCSV)
2	Central gateway module (ZGM)
3	Electronic power steering (EPS)
4	Head-Up Display (HUD)
5	Car Access System (CAS)
6	Digital Motor Electronics (DME)
7	Instrument panel (KOMBI)
8	Electronic Damper Control satellite, front right (EDCSV)
9	Central information display (CID)
10	High-beam assistant (FLA) (Not US)
11	Front light control module (FLCM)
12	Front light control module (FLCM)
13	Front light control module (FLCM)
14	Front light control module (FLCM)
15	Front light control module (FLCM)
16	Front light control module (FLCM)
17	Front light control module (FLCM)
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19	Front light control module (FLCM)
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35	Front light control module (FLCM)
36	Front light control module (FLCM)
37	Front light control module (FLCM)
38	Front light control module (FLCM)
39	Front light control module (FLCM)
40	Front light control module (FLCM)
41	Front light control module (FLCM)
42	Front light control module (FLCM)
43	Front light control module (FLCM)

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2. Vehicle electrical system

Index	Explanation
11	Advanced Crash Safety Module (ACSM)
12	Junction box electronics (JBE) Park Distance Control (PDC)
13	Vertical Dynamics Management (VDM)
14	DVD changer (DVDC)
15	Front passenger seat module (SMBF)
16	Electronic fuel pump control (EKP)
17	Combox (Combox multimedia with telematics)
18	Video Module (VM) (Not US)
19	Convertible top module (CVM)
20	Electronic Damper Control satellite, rear right (EDCSHR)
21	Blind Spot Detection (SWW)
22	Siren with tilt alarm sensor (SINE)
23	Electromechanical parking brake (EMF)
24	Tire Pressure Monitor System (TPMS)
25	Parking maneuvering assistant (PMA)
26	Rear axle slip angle control (HSR)
27	Top HiFi amplifier (AMPT)
28	Control unit for camera systems (TRSVC)
29	Video switch (VSW)
30	Electronic Damper Control satellite, rear left (EDCSHL)
31	Automatic integrated heating and A/C control unit (IHKA)
32	Integrated Chassis Management (ICM)
33	Controller (CON)
34	Gear selector switch (GWS)
35	Car information computer (CIC)
36	Electronic transmission control (EGS)
37	Driver's seat module (SMFA)
38	Steering column switch cluster (SZL)
39	Active steering (AL)
40	Night vision electronics (NVE)
41	Dynamic Stability Control (DSC)
42	Footwell module (FRM)
43	Camera-based driver support systems (KAFAS)

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3. Voltage supply

The voltage supply concept of the F12 is based on current BMW models. The components and layout used are essentially the same.

3.1. Components

Due to the steady increase of electrical functions for comfort, communication and safety in BMW vehicles, the voltage supply is becoming ever more important.

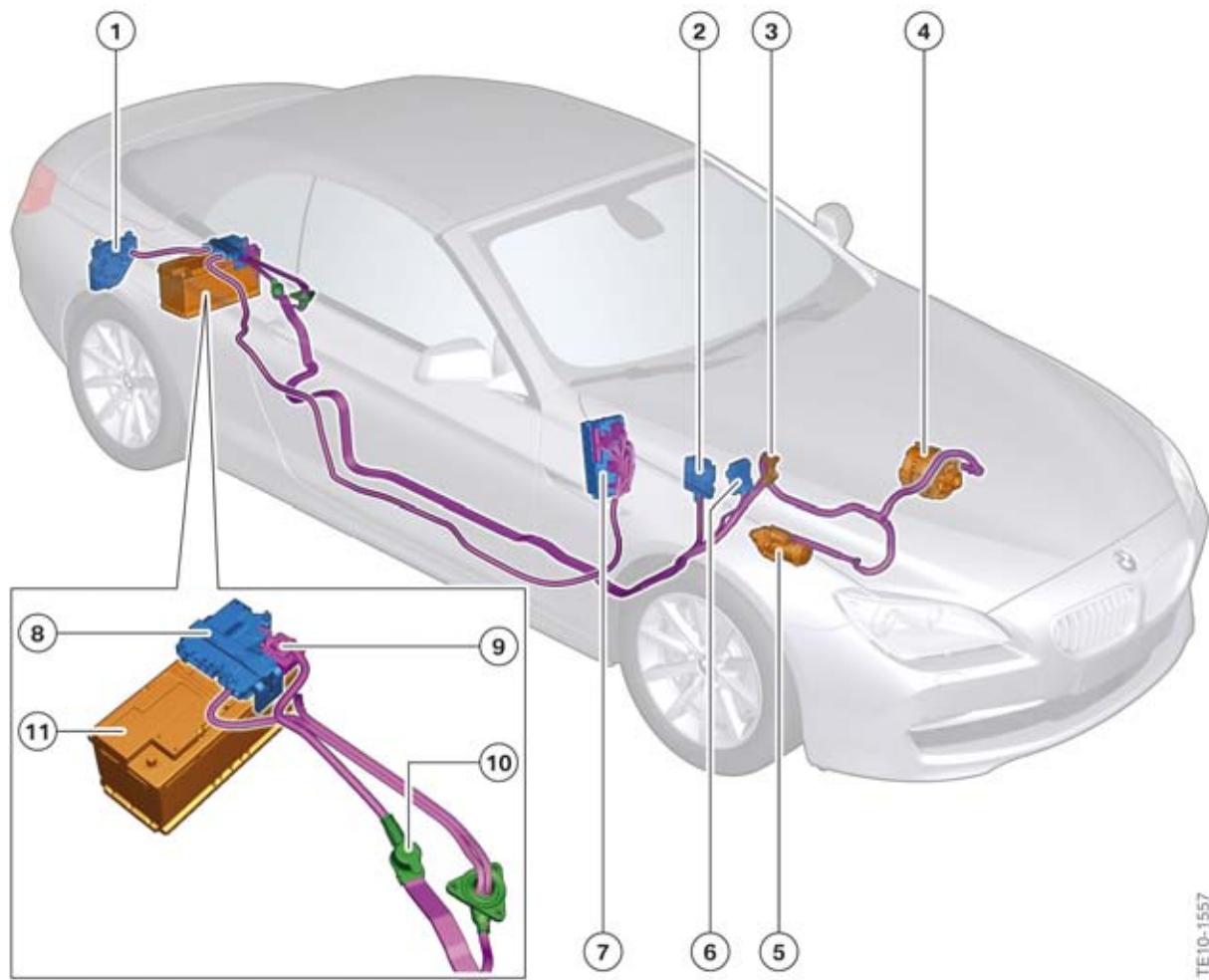
Five separate power distribution boxes are installed in the F12:

- Power distribution box in the engine compartment
- Power Distribution Module PDM in engine compartment (only on 640i with the N55B30O0 engine).
- Junction box for the power distribution box next to the glove box
- Luggage compartment power distribution box on right side of the luggage compartment
- Battery power distribution box.

The junction box comprises the junction box power distribution box and junction box electronics (JBE).

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3. Voltage supply



TE10-1557

F12 Main power lines

Index	Explanation
1	Luggage compartment power distribution box
2	Power Distribution Module PDM (only on 640i with the N55B30O0 engine).
3	Positive battery connection point
4	Alternator
5	Starter motor
6	Power distribution box, engine compartment
7	Junction box for the power distribution box
8	Battery power distribution box
9	Safety battery terminal (SBK)
10	Transition connection point
11	Battery

F12 General Vehicle Electronics

3. Voltage supply

Three main power lines are routed along the vehicle underbody of the F12 from the luggage compartment to the engine compartment:

- A main power line runs from the safety battery terminal (SBK) to the starter motor and alternator via the positive battery connection point. Copper cable with a cross-section of 50 mm² is used up to the transition connection point below the luggage compartment floor and aluminum cable with a cross-section of 80 mm² is used from this point onwards.
- The second main power line supplies voltage to the Power Distribution Module (PDM). This copper cable has a cross-section of 16 mm² and is protected by a high-current circuit breaker in the battery power distribution box.
- The third main power line runs to the power distribution box in the engine compartment. Current is supplied to the electrical fan via this power distribution box. This line is also protected by the high-current circuit breaker in the battery power distribution box and is a copper cable with a cross-section of 25 mm².

Two additional battery cables run through the vehicle interior to the luggage compartment power distribution box and one battery cable runs to the junction box for the power distribution box. Each of the three battery cables is protected by a high-current circuit breaker in the battery power distribution box.

To prevent the main power lines on the vehicle underbody from being damaged, these are laid in a protected zone.

3.1.1. Battery

Voltage in the F12 is always supplied by a 90 Ah AGM (absorbent glass matt) battery. The vehicle battery is installed at the rear of the luggage compartment in the Center.



AGM battery

With the introduction of the F10, the intelligent battery sensor (IBS) has been used to improve the battery condition detection. The following criteria are used to establish whether or not the battery in the F12 is defective and needs to be replaced:

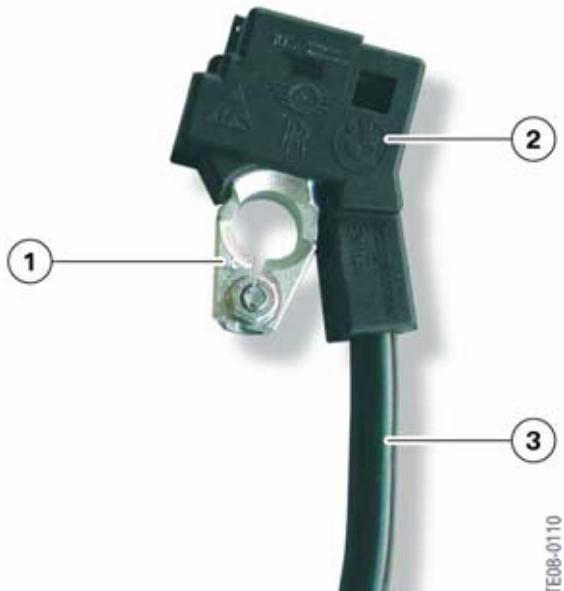
- Identification of faulty battery cells in the vehicle battery
- Establishing the remaining capacity of the vehicle battery
- Battery water loss detected

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3. Voltage supply

- Long immobilization period with low state of charge
- Charge capacity
- Charge balance when the vehicle is at a standstill
- Charge balance during journey
- Lowest permitted discharging

These criteria are recorded using the measured values obtained from the intelligent battery sensor and other measured variables of the voltage supply. The measured values are then evaluated using mathematical models. Only specific criteria may be used to determine the battery condition, depending on the driving style and equipment used in the vehicle.



Intelligent battery sensor (IBS)

Index	Explanation
1	Negative battery terminal
2	Intelligent battery sensor
3	Battery earth lead

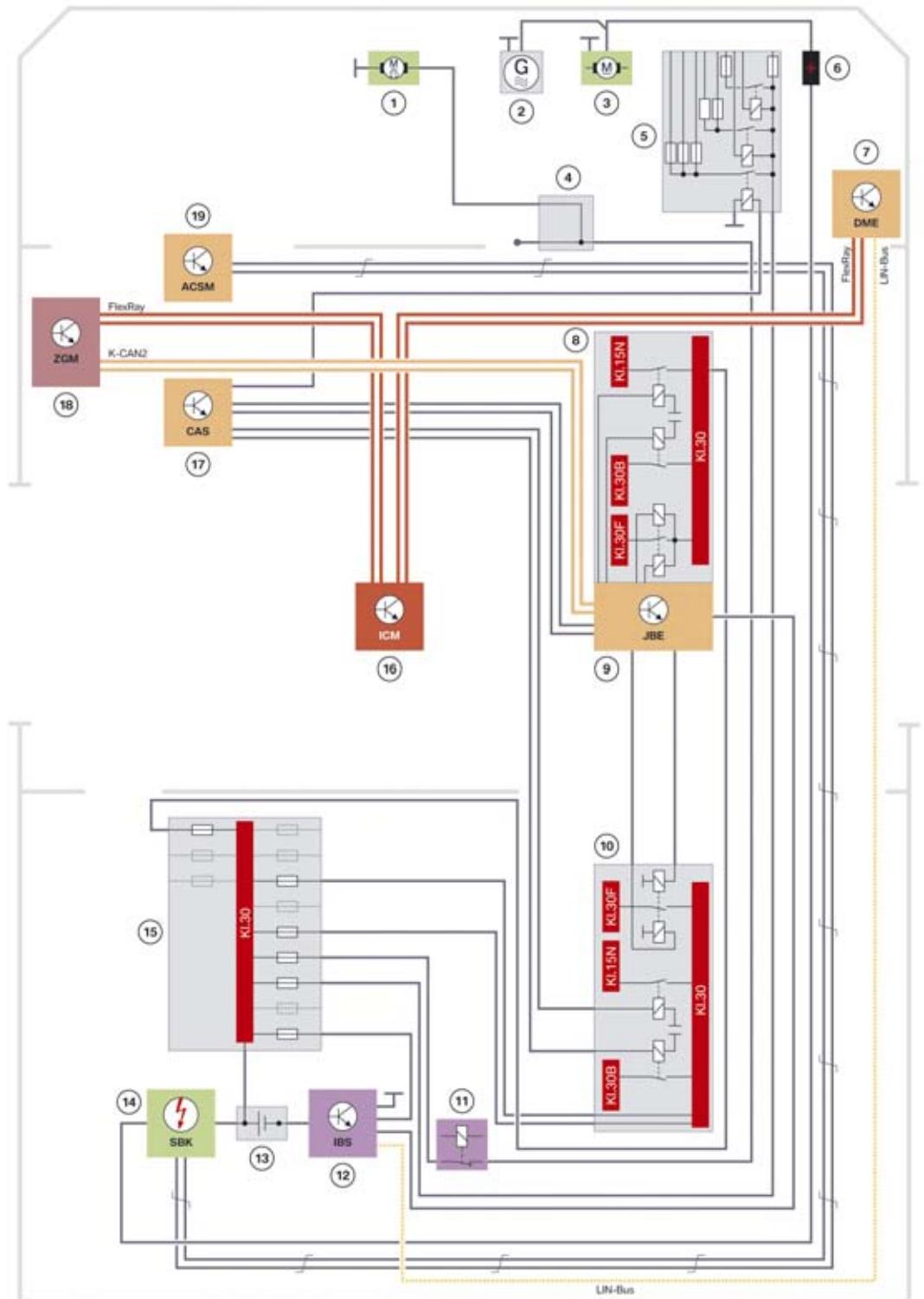
The battery condition detection determines whether the battery needs to be replaced based on the severity and number of defects detected. Furthermore, the vehicle user is notified via the "Change battery" Check Control message that a problem may exist. The fault entry can only be deleted once the vehicle battery change service function has been carried out.

The condition of the battery can be read out during service via the "battery condition" or "energy diagnosis" procedures ("General information / battery" menu) in order to determine whether it needs to be replaced.

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3. Voltage supply

3.2. System wiring diagram



F12 System wiring diagram of voltage supply

TE10-1465

F12 General Vehicle Electronics

3. Voltage supply

Index	Explanation
1	Electric fan
2	Alternator
3	Starter motor
4	Power distribution box, engine compartment
5	Power Distribution Module (PDM) (only on 640i with the N55B30O0 engine)
6	Positive battery connection point
7	Digital Motor Electronics (DME)
8	Junction box for the power distribution box
9	Junction box electronics (JBE)
10	Luggage compartment power distribution box ¹ (not US)
11	Relay for electric fan
12	Intelligent battery sensor (IBS)
13	Battery
14	Safety battery terminal (SBK)
15	Battery power distribution box
16	Integrated Chassis Management (ICM)
17	Car Access System (CAS)
18	Central gateway module (ZGM)
19	Crash Safety Module (ACSM)
Terminal 15N	Ignition (after-run)
Terminal 30	Terminal 30
Terminal 30B	Terminal 30, basic operation
Terminal 30F	Terminal 30, fault-dependent
LIN-Bus	Local interconnect network bus

¹ In vehicles equipped with the automatic engine start-stop function (MSA), terminal 30B_DC/DC is also in the power distribution box in the luggage compartment (not currently available in the US model).

3.3. Energy management

The F12 energy management has been extended to include a number of functions.

3.3.1. Charge condition display

If the F12 is in transport mode, the battery's state of charge is continuously displayed when in operation. The carrier can therefore charge the battery on time in order to prevent deep discharging of the battery, and therefore damage to the battery:

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3. Voltage supply

3.3.2. Influence of steering power

The power consumption of the electric power steering (EPS) is extremely high. In order to avoid a brief reduction in the steering servo availability, the energy management of the F12 anticipates and responds to steering-intensive driving maneuvers (parking or three-point turns). To do this, specific input variables (e.g. vehicle speed, brake pedal operation and steering angle) are evaluated. The energy management can implement the following measures:

- Raise the idling speed and adjust the ignition timing to increase the engine torque
- Increase the vehicle voltage via the alternator
- Turn off convenience functions (heated rear window, outside mirror heating system and seat heating).

3.4. Supply to EPS

The voltage supply to the Electric Power Steering (EPS) varies depending on which equipment installed in the vehicle:

- Vehicles without Integral Active Steering (SA 2VH): 12 V
- Vehicles with Integral Active Steering (SA 2VH): 24 V.

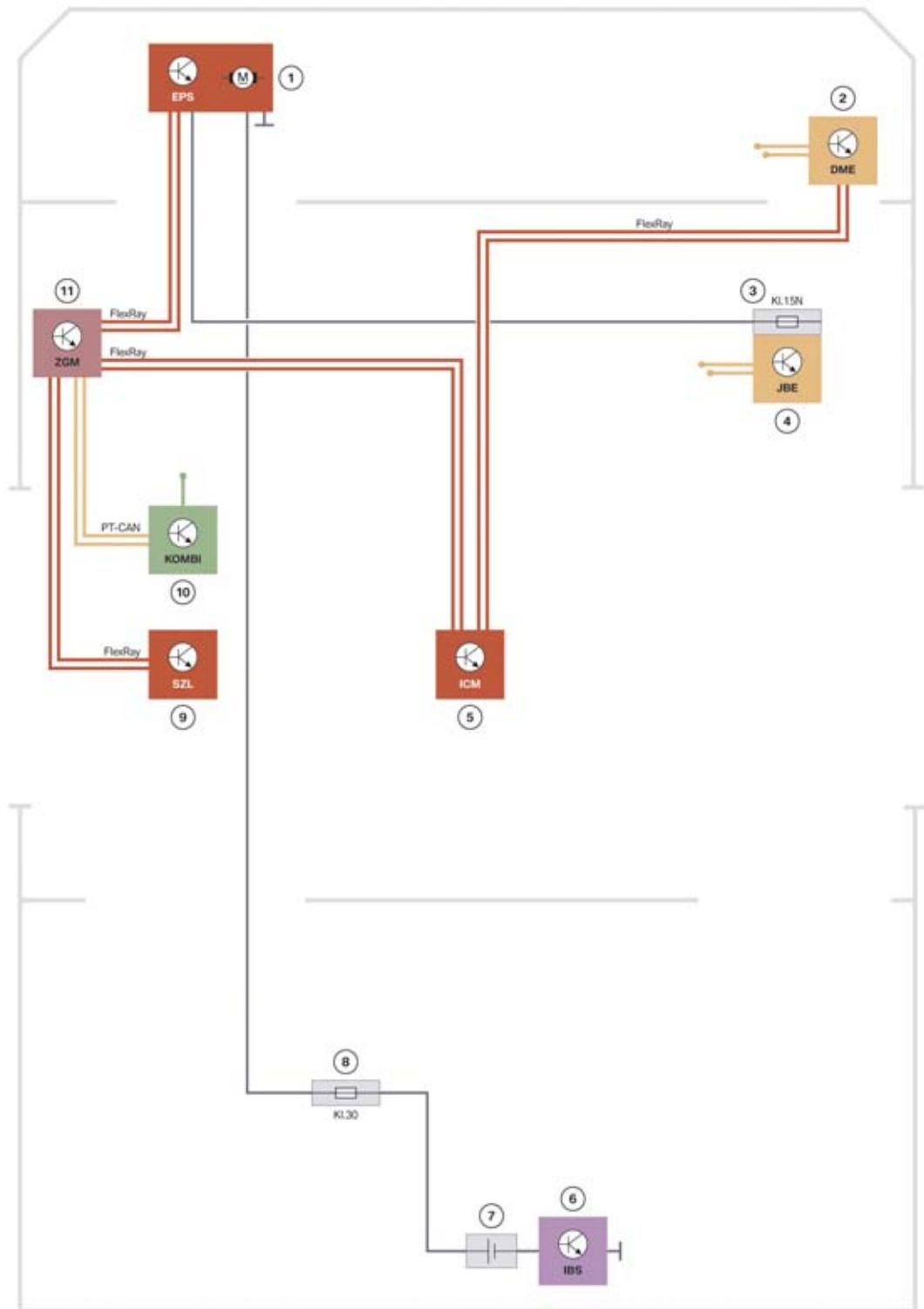
With this version, the steering servo is fully electric. In vehicles with Integral Active Steering (SA 2VH), the Electric Power Steering (EPS) is combined with a planetary gearbox with override function.

For more information on the Electric Power Steering (EPS), refer to the F12 Chassis Dynamics section of this training material.

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3. Voltage supply

3.4.1. System wiring diagram



F12 EPS system wiring diagram, 12 V

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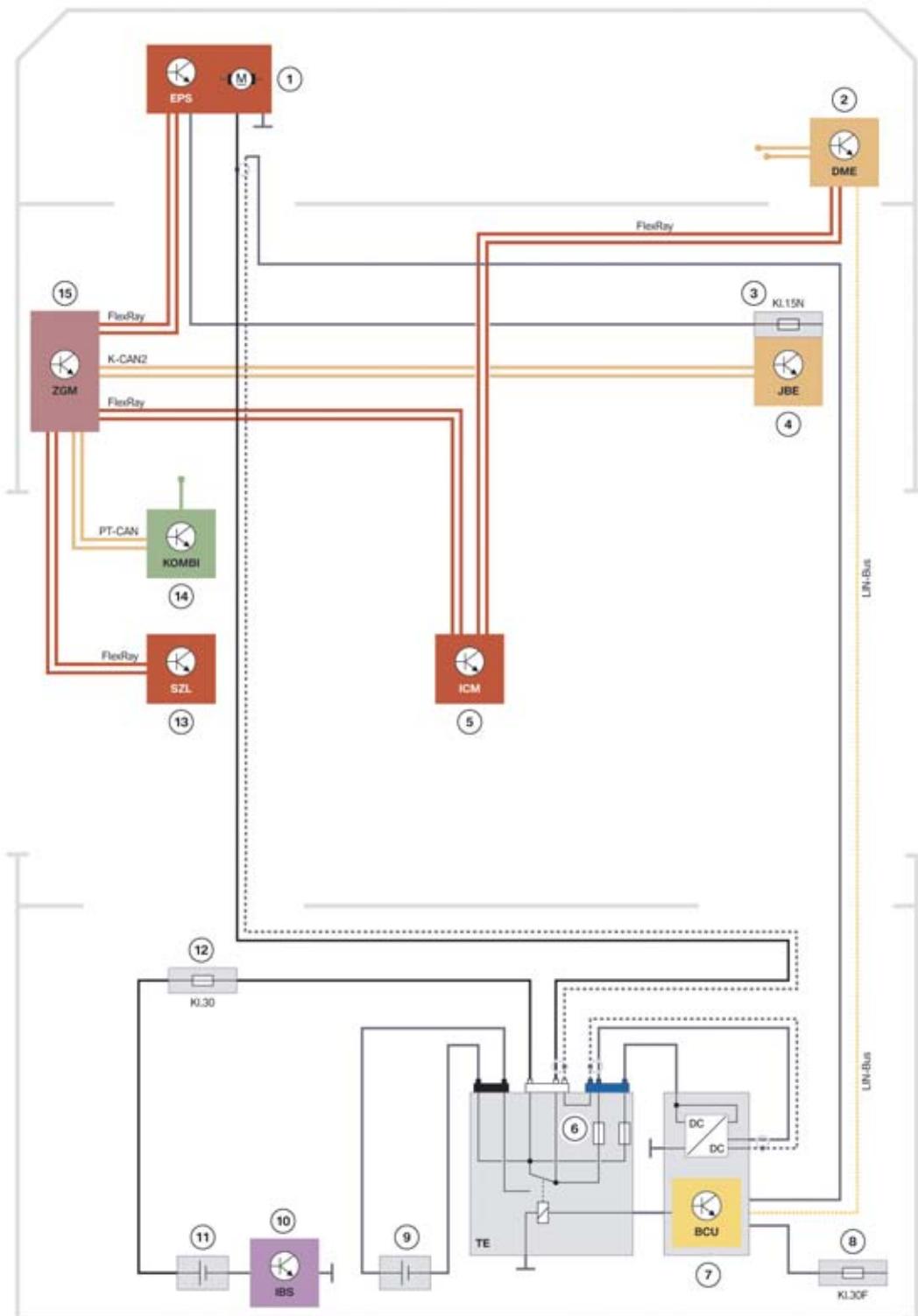
F12 General Vehicle Electronics

3. Voltage supply

Index	Explanation
1	Electric Power Steering (EPS)
2	Digital Motor Electronics (DME)
3	Junction box for the power distribution box
4	Junction box electronics (JBE)
5	Integrated Chassis Management (ICM)
6	Intelligent battery sensor (IBS)
7	Battery
8	Battery power distribution box
9	Steering column switch cluster (SZL)
10	Instrument panel (KOMBI)
11	Central gateway module (ZGM)
Terminal 15N	Ignition (after-run)
Terminal 30	Terminal 30

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3. Voltage supply



F12 System wiring diagram of EPS with 24 V and active steering

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3. Voltage supply

Index	Explanation
1	Electric Power Steering (EPS)
2	Digital Motor Electronics (DME)
3	Junction box for the power distribution box
4	Junction box electronics (JBE)
5	Integrated Chassis Management (ICM)
6	Separator
7	Charging controller for auxiliary battery (Battery Charge Unit [BCU])
8	Luggage compartment power distribution box
9	Auxiliary battery
10	Intelligent battery sensor (IBS)
11	Battery
12	Battery power distribution box
13	Steering column switch cluster (SZL)
14	Instrument panel (KOMBI)
15	Central gateway module (ZGM)
Terminal 15N	Ignition (after-run)
Terminal 30	Terminal 30
Terminal 30F	Terminal 30, fault-dependent
LIN-Bus	Local interconnect network bus

F12 General Vehicle Electronics

4. Car Access System

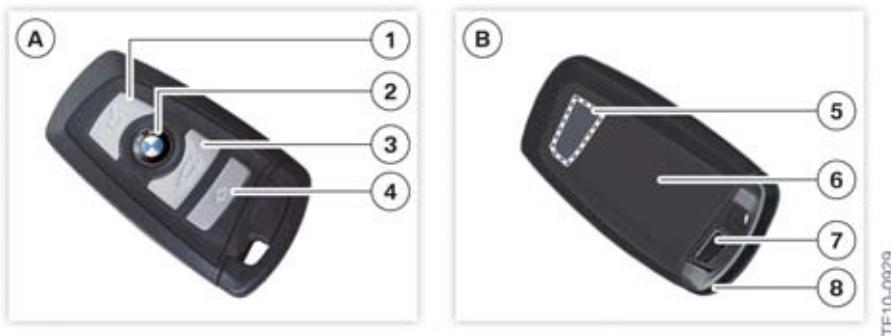
The fourth generation Car Access System used in current BMW models is also used in the F12. With it comes the full functionality of Comfort Access integrated into the Car Access System.

As of series introduction, the drive authorization (Passive Go) system is fitted as standard equipment in the F12. Drive authorization allows the customer to start the engine without actively using the remote key or ID transmitter. Vehicles equipped with drive authorization require no insertion slot. An ID transmitter or remote key only needs to be somewhere inside the passenger compartment for the engine to be started.

The remote key/ID transmitter comprises, among other things:

- A battery
- Remote control function
- Transponder coil for emergency start function
- Spare key
- Receiver unit.

Up to eight remote keys/ID transmitters can be used with a particular vehicle. The battery has a four year estimated service life.



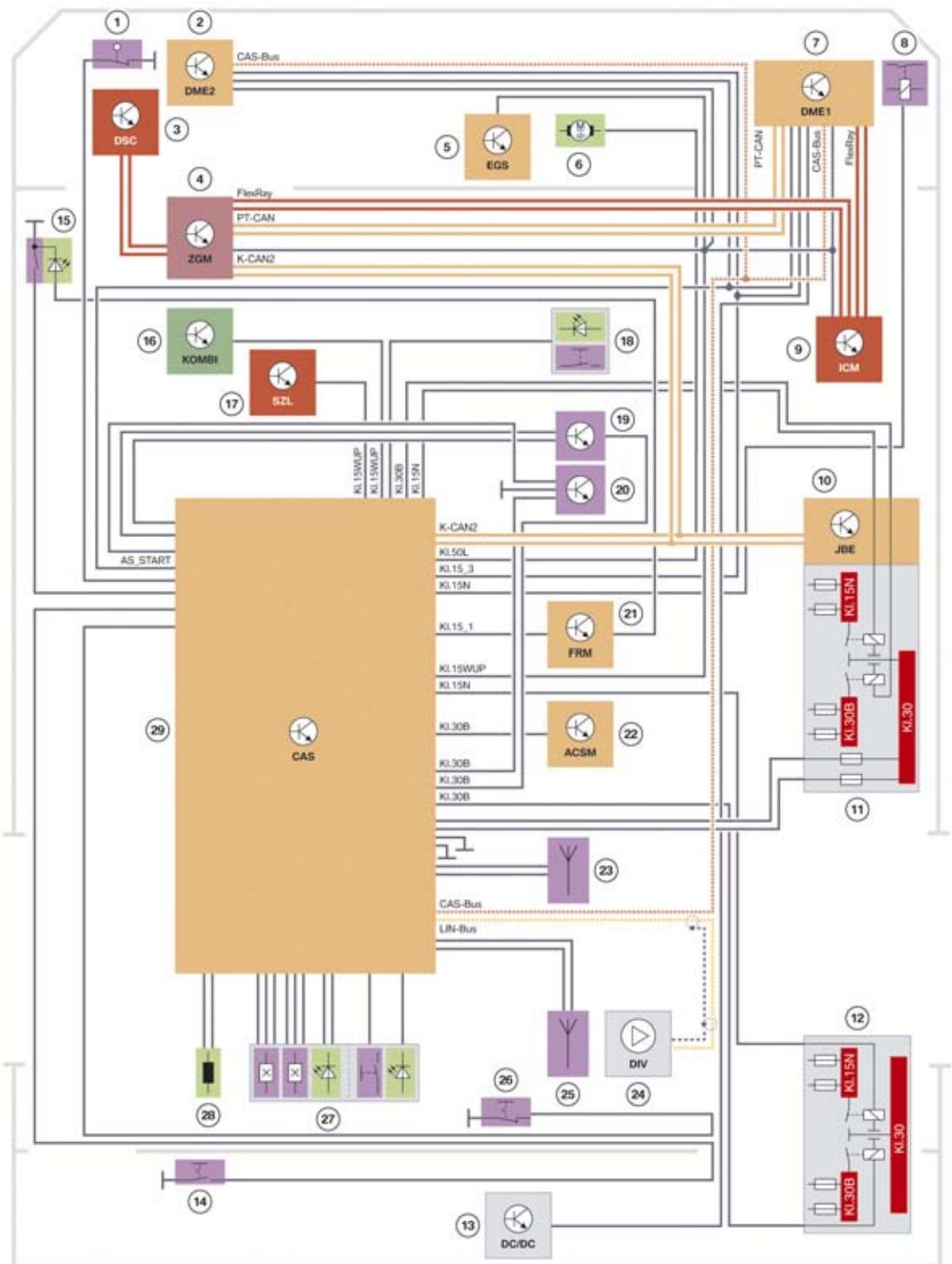
F12 Remote key/ID transmitter

Index	Explanation
1	Unlock vehicle button
2	Lock vehicle button
3	Unlock trunk push button
4	Panic mode
5	Area for ring antenna (transponder coil for emergency start)
6	Battery compartment lid
7	Integrated key release button
8	Integrated key
A	Top view
B	Rear view

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4. Car Access System

4.1. System wiring diagram



F12 System wiring diagram of Car Access System

TE10-1382

F12 General Vehicle Electronics

4. Car Access System

Index	Explanation
1	Engine compartment lid contact switch
2	Digital Motor Electronics (DME)
3	Dynamic Stability Control (DSC)
4	Central gateway module (ZGM)
5	Electronic transmission control (EGS)
6	Starter motor
7	Digital Motor Electronics (DME)
8	Power Distribution Module
9	Integrated Chassis Management (ICM)
10	Junction box electronics (JBE)
11	Junction box for the power distribution box
12	Luggage compartment power distribution box
13	DC/DC converter (for MSA)* (not US)
14	Central locking system button on inside of trunk
15	trunk push-button
16	Instrument panel (KOMBI)
17	Steering column switch cluster (SZL)
18	Button for central locking system/hazard warning switch
19	Brake light switch
20	Clutch switch (with manual gearbox only)
21	Footwell module (FRM)
22	Crash Safety Module (ACSM)
23	Interior antenna for Comfort Access
24	Antenna diversity with remote control receiver
25	Interior antenna for Comfort Access
26	Hotel position switch
27	Start/stop button ¹
28	Ring antenna (transponder coil)
29	Car Access System (CAS)
AS_START	Start/start termination (DME)
CAS-Bus	Car Access System bus
Terminal 15_1	Ignition (output 1)
Terminal 15_3	Ignition (output 3)
Terminal 15N	Ignition (after-run)
Terminal 15WUP	Wake-up with terminal 15 ON

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4. Car Access System

Index	Explanation
Terminal 30	Terminal 30
Terminal 30B	Terminal 30, basic operation
Terminal 50	Terminal 50 load
LIN-Bus	Local interconnect network bus

* Additional button with LED (shown to right of start/stop button) only in vehicles with automatic engine start-stop function (MSA). (not available in the US)

4.2. Overview of functions

The Car Access System performs, among other functions, the role of central control unit via which the vehicle is accessed and locked. Consequently, the Car Access System has full responsibility for the central locking system.

The Car Access System incorporates the following functions for the F12:

- Comfort Access
- Central locking system
- Power window regulators
- Terminal control
- Electronic immobilizer.

Other functions of the Car Access System are:

- Vehicle data storage
- Data transfer for Conditioned Based Service (CBS)
- Plausibility check of signals from remote key/ID transmitter.

Various functions are released or suppressed by the Car Access System. However, other control units are involved in actually carrying out these functions:

- Junction box electronics (JBE)
- Footwell module (FRM)
- Roof function Center (FZD).

For the purposes of communication with other components of the vehicle electrical system, the Car Access System is connected to the K-CAN2, CAS data bus and local interconnect network bus.

The Car Access System analyzes the status of the hood contact switch and broadcasts it for use by the alarm system.

The Car Access System also analyzes the status of the following buttons and initiates the central locking function.

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4. Car Access System

- Button for central locking system on dashboard
- Trunk lid push-button on A-pillar
- Central locking system button on inside of trunk.

The Car Access System supplies voltage to the brake light switch and also analyzes its status.

A remote key/ID transmitter must be located in the passenger compartment in order for the engine to be started. The engine can now be started by pressing the start/stop button with the brake pedal pressed and the vehicle is operational.

For a more detailed description of the functions, please read the "F01/F02 Car Access System" training material available on TIS and ICP.

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5. Comfort Access

Using Comfort Access, the customer can unlock and open the vehicle without actively using the ID transmitter irrespective of where in the vehicle the customer wishes to gain access. It is sufficient if the ID transmitter is in the immediate vicinity (within a range of about. 1.5 m) of the vehicle.

Comfort Access first featured in the E65 (03/2002) then was successively introduced in various BMW models. The F12 is standard equipment from series introduction.

The benefits of Comfort Access are:

- High level of operating convenience when unlocking and locking the vehicle
- Convenient and fast access to the vehicle
- Simple engine start/shutdown procedure
- Maximum comfort for the driver.

The Comfort Access that features in the F12 is a version that is based on predecessor systems and has been adapted to the requirements of the F12. As is the case with current BMW models, the entire function is incorporated into the Car Access System which means the F12 also has no separate Comfort Access control unit.

If the ID transmitter has been detected and is grasped by a hand reaching into the handle recess of the outer door handle on one of the doors, the vehicle unlocks and can then be opened by pulling the outer door handle.

If the ID transmitter is outside the vehicle and the sensitive surface on the outer door handle of one of the doors is touched, the vehicle locks.

Comfort Access is divided into the following functions:

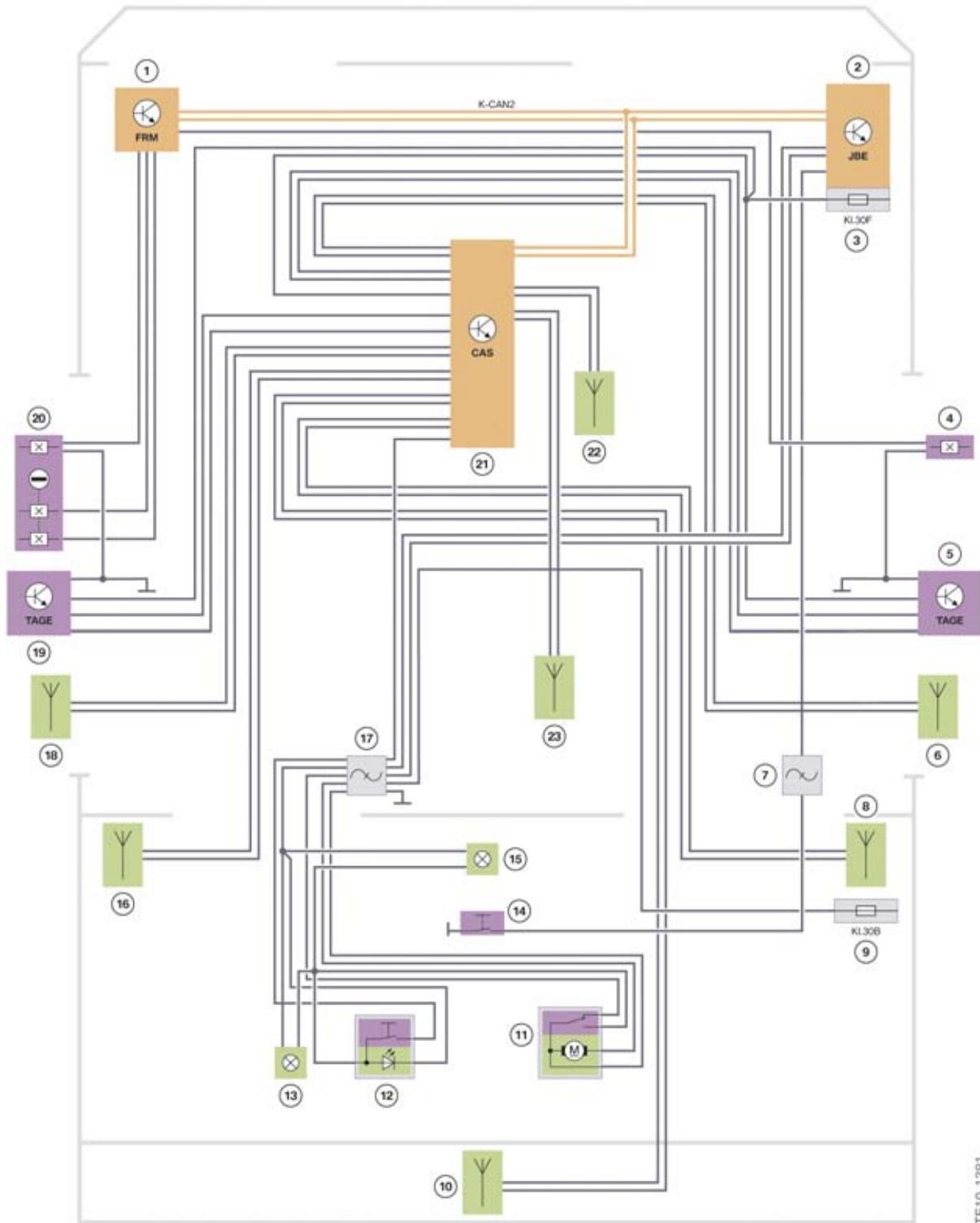
- Access authorization (Passive Entry)
- Drive authorization (Passive Go)
- Locking authorization (Passive Exit).

For a more detailed description of the functions, refer to the "F01/F02 Comfort Access " training material available on TIS and ICP.

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5. Comfort Access

5.1. System wiring diagram



F12 Comfort Access system wiring diagram

TE10-138

F12 General Vehicle Electronics

5. Comfort Access

Index	Explanation
1	Footwell module (FRM)
2	Junction box electronics (JBE)
3	Junction box for the power distribution box
4	Door contact, front passenger side
5	Outside door handle electronics (TAGE) on front passenger side
6	Comfort Access aerial (door entrance on right)
7	Interference suppression filter
8	Luggage compartment antenna, front passenger side
9	Luggage compartment power distribution box
10	Antenna for Comfort Access (rear bumper)
11	Trunk lid contact with trunk lock
12	Central locking system button on inside of trunk
13	Trunk lid light
14	Trunk lid push-button
15	Luggage compartment light
16	Luggage compartment antenna, driver side
17	Interference suppression filter
18	Comfort Access antenna (entrance on left)
19	Outside door handle electronics TAGE on driver side
20	Door contact, hall effect sensors for lock barrel on driver side
21	Car Access System with CA Comfort Access function
22	Antenna for Comfort Access (vehicle interior, front)
23	Antenna for Comfort Access (vehicle interior, rear)
Terminal 30B	Terminal 30, basic operation
Terminal 30F	Terminal 30, fault-dependent

F12 General Vehicle Electronics

6. Central locking system

The central locking system locks and unlocks all doors, the fuel filler flap and trunk centrally. It is installed in the F12 as standard and can be operated via the following components:

- Remote key/ID transmitter
- Driver's door lock barrel (door lock)
- Outer door handle
- Button for central locking system on dashboard
- Button for central locking system on inside of trunk
- Trunk lid push-button on A-pillar
- Trunk lid push-button on outside of trunk lid (integrated in BMW badge).

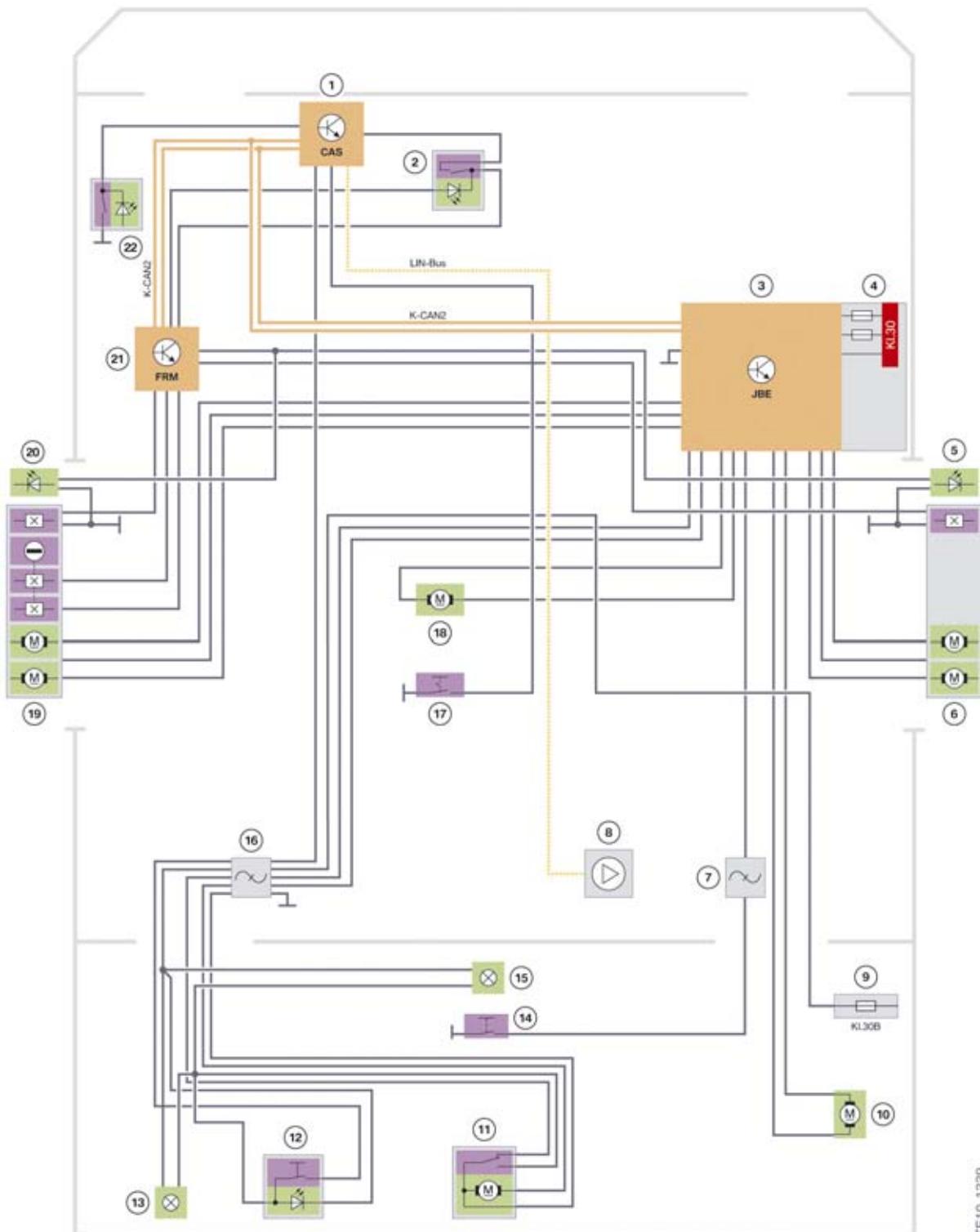
The F12 has no lock in the Trunk lid that can be unlocked mechanically.

The central locking system in the F12 is based on the familiar central locking system that already features in the E70, E90 or F01/F02.

F12 General Vehicle Electronics

6. Central locking system

6.1. System wiring diagram



F12 Central locking system wiring diagram

TE10-1339

F12 General Vehicle Electronics

6. Central locking system

Index	Explanation
1	Car Access System (CAS)
2	Button for central locking system/hazard warning switch
3	Junction box electronics (JBE)
4	Junction box for the power distribution box
5	Ground lights, front passenger side
6	Door contact, central locking system on front passenger side, front
7	Interference suppression filter
8	Remote control receiver
9	Luggage compartment power distribution box
10	Central locking system, fuel filler flap
11	Trunk lid contact with trunk lock
12	Central locking system button inside the trunk
13	Trunk lid light
14	Trunk lid push-button
15	Luggage compartment light
16	Interference suppression filter
17	Hotel position switch (only in US version)
18	Central locking system, Center armrest
19	Door contact, hall effect sensors for lock barrel, central locking system on driver's side front
20	Ground lights, driver's side
21	Footwell module (FRM)
22	Trunk lid push-button
Terminal 30	Terminal 30
Terminal 30B	Terminal 30, basic operation
LIN-Bus	Local interconnect network bus

6.2. Overview of functions

The function of the central locking system is basically divided between two control units.

- The Car Access System assumes the central control function. The Car Access System knows what the system statuses of the central locking system are which is why the Car Access System authorizes the unlocking, locking and deadlocking of the vehicle.
- The junction box electronics executes the requests to unlock or lock the vehicle.

The vehicle can be unlocked and locked actively or passively.

F12 General Vehicle Electronics

6. Central locking system

Active means that the vehicle can be opened after it has been unlocked by pressing the button on the remote key/ID transmitter. The vehicle can be locked by pressing the "lock" button after the doors have been closed.



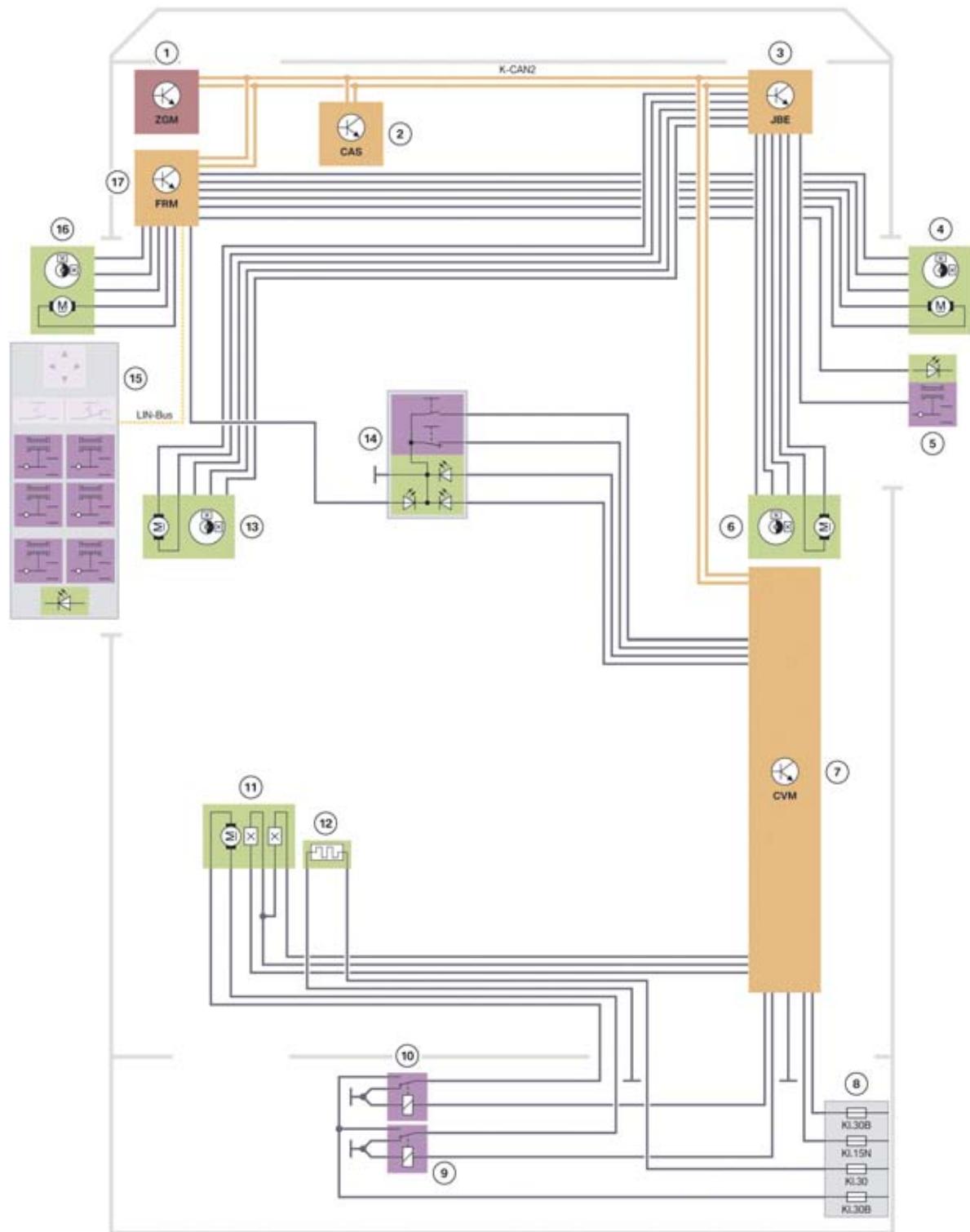
The vehicle can only be locked when the driver's door is closed.

For a more detailed description of the functions, refer to the "F01/F02 Central locking system" training material available on TIS and ICP.

F12 General Vehicle Electronics

7. Power window regulator

7.1. System wiring diagram



F12 Power window regulator system wiring diagram

TE10-1506

F12 General Vehicle Electronics

7. Power window regulator

Index	Explanation
1	Central gateway module (ZGM)
2	Car Access System (CAS)
3	Junction box electronics (JBE)
4	Power window motor with indirect anti-trap mechanism on front passenger side at front
5	Power window switch, front passenger side
6	Power window motor with indirect anti-trap mechanism on front passenger side at rear
7	Convertible top module (CVM)
8	Luggage compartment power distribution box
9	Relay for raising rear window
10	Relay for lowering rear window
11	Rear-window drive
12	Heated rear window
13	Power window motor with indirect anti-trap mechanism on driver's side at rear
14	Button for opening/closing convertible top
15	Switch block, driver's door
16	Power window motor with indirect anti-trap mechanism on driver's side at front
17	Footwell module (FRM)
Terminal 15N	Ignition (after-run)
Terminal 30	Terminal 30
Terminal 30B	Terminal 30, basic operation
LIN-Bus	Local interconnect network bus

7.2. Examples of the signal path

The following examples show the signal paths before the power window motors open or close the side windows and rear window. As a prerequisite, operation of the power windows must have been enabled by the Car Access System.

7.2.1. Switch block, driver's door

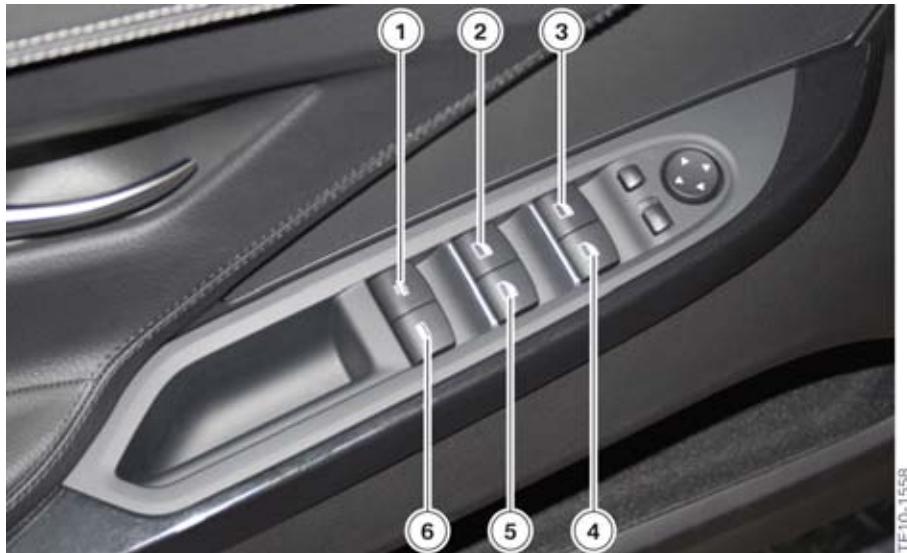
If the front left or front right power window switch is pressed, the signal is routed to the footwell module via the local interconnect network (LIN) bus. The footwell module controls the relevant power window motor.

If the rear left or rear right power window switch is pressed, the signal from the switch block in the driver's door is routed to the footwell module via the local interconnect network (LIN) bus. The footwell module sends the signal to the junction box electronics via the body controller area network 2 (K-CAN 2). The junction box electronics (JBE) controls the relevant power window motor.

F12 General Vehicle Electronics

7. Power window regulator

If the rear window power window switch is pressed, the signal from the switch block in the driver's door is sent to the footwell module (FRM) via the local interconnect network (LIN) bus. The footwell module sends the signal to the convertible top module (CVM) via the body controller area network 2 (K-CAN 2). The convertible top module (CVM) actuates the relay that lowers or raises the rear window and receives the signals from the hall effect sensors via which the position of the rear window is identified. The rear-window drive is actuated via the relay that lowers or raises the rear window.



F12 Switch block, driver's door

Index	Explanation
1	Power window switch that opens/closes all four side windows and rear window simultaneously
2	Power window switch, rear left
3	Power window switch, front left
4	Power window switch, front right
5	Power window switch, rear right
6	Button that operates the rear window

7.2.2. Power window switch, front passenger door

The signal is routed to the junction box electronics (JBE) when the power window switch in the front passenger door is operated. The junction box electronics sends the signal to the footwell module (FRM) via the body controller area network 2 (K-CAN 2). The footwell module controls the relevant power window motor.

F12 General Vehicle Electronics

8. Anti-theft system

The Anti-theft system (DWA) is standard equipment of the F12. Its purpose is to indicate when the vehicle is accessed without authorization by emitting an alarm warning. The alarm can be activated acoustically or visually. To do this, the alarm system must be activated. When activated, the alarm system monitors the whole of the vehicle interior.

In addition the alarm system monitors the engine compartment and the vehicle's rest position. In order that nothing can be stolen from the luggage compartment, the alarm system monitors opening of the trunk lid.

The alarm system also signals when an attempt is made to tamper with the vehicle, e.g. by cutting through the feed line to the siren with tilt alarm sensor (SINE).

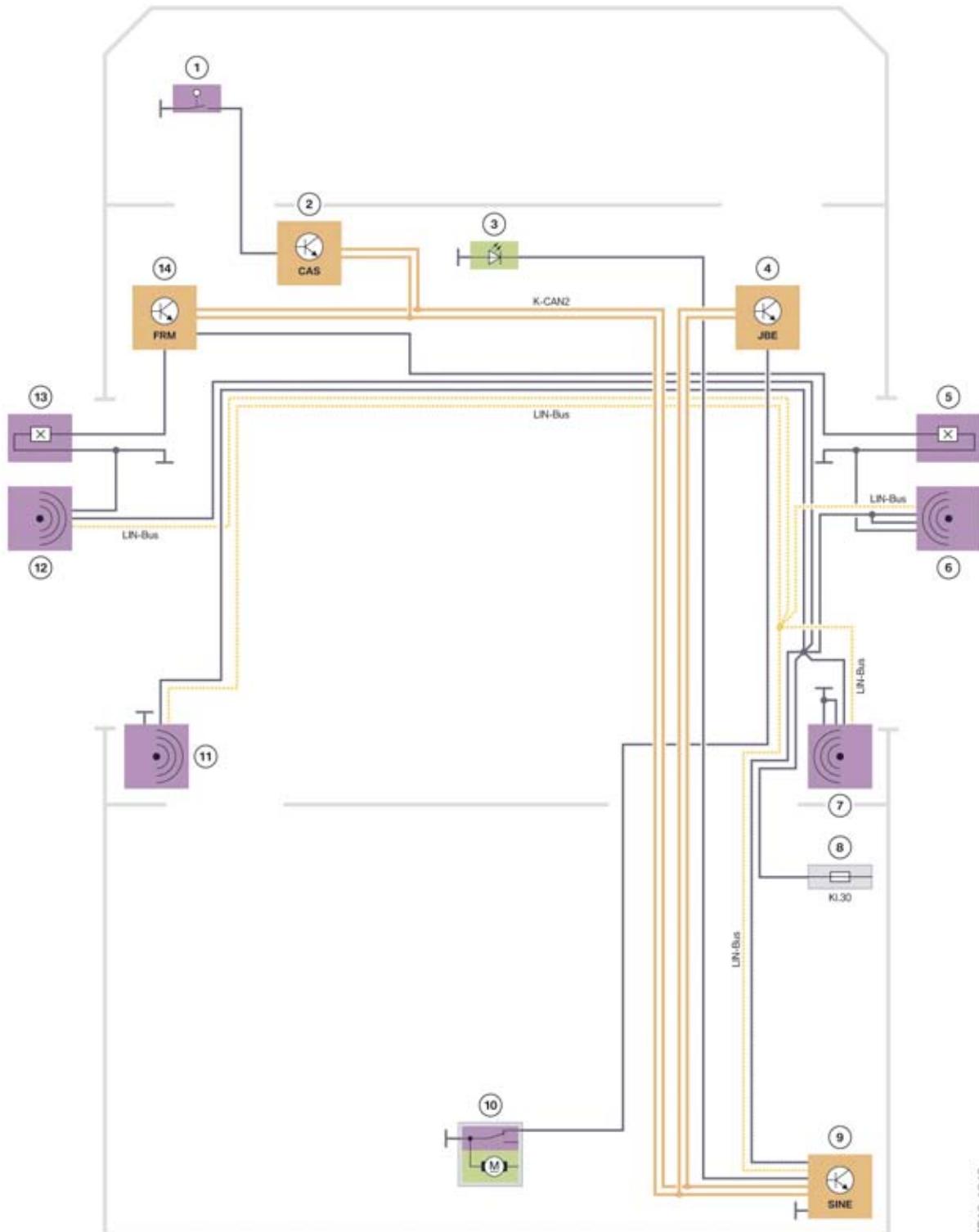
The passenger compartment is monitored by four MuW (multiplex microwave sensors) sensors in total via a radar-based measuring procedure. These are located behind the door and side trim panels. When monitoring is in progress the MuW sensors detect all movements and directions of movement. The siren with tilt alarm sensor (SINE) activates the MuW sensors.

The siren with tilt alarm sensor SINE is located on the right, on the bumper side support.

F12 General Vehicle Electronics

8. Anti-theft system

8.1. System wiring diagram



F12 Alarm system

TE10-1340

F12 General Vehicle Electronics

8. Anti-theft system

Index	Explanation
1	Engine compartment lid contact switch
2	Car Access System (CAS)
3	Light-emitting diode (DWA)
4	Junction box electronics (JBE)
5	Door contact, front passenger side
6	MuW sensor, front passenger side at front
7	MuW sensor, front passenger side at rear
8	Luggage compartment power distribution box
9	Siren with tilt alarm sensor (SINE)
10	Trunk lid contact with trunk lock
11	MuW sensor, front passenger side at rear
12	MuW sensor, driver's side at front
13	Door contact, driver's side
14	Footwell module (FRM)
Terminal 30	Terminal 30
LIN-Bus	Local interconnect network bus

The status of the following components is monitored:

- the door contacts, by the footwell module (FRM)
- the engine compartment lid contact switch, by the Car Access System (CAS)
- the rear lid contact switch, by the junction box electronics (JBE).

As soon as a status changes, the siren with tilt alarm sensor (SINE) receives a corresponding signal. If the alarm system is activated, an alarm is triggered.

F12 General Vehicle Electronics

9. Exterior lights

The exterior lights of the F12 are based on most current BMW models.

The standard equipment of the F12 includes bi-xenon headlights. The daytime running lights and side lights are implemented in the corona rings using LED technology and thus guarantee a high recognition value in traffic.

The LEDs can be operated in two power stages. When dimmed to roughly 10% of their maximum power they operate as side lights, while at full power they operate as daytime driving lights.

The daytime driving lights are activated when the vehicle is started. If the automatic lighting system switches the low-beam headlight on, or if the driver switches the side lights or low-beam headlight on at the light switch himself, the light ring changes automatically to side lights.

A white LED positioning light (eyebrow) is installed.

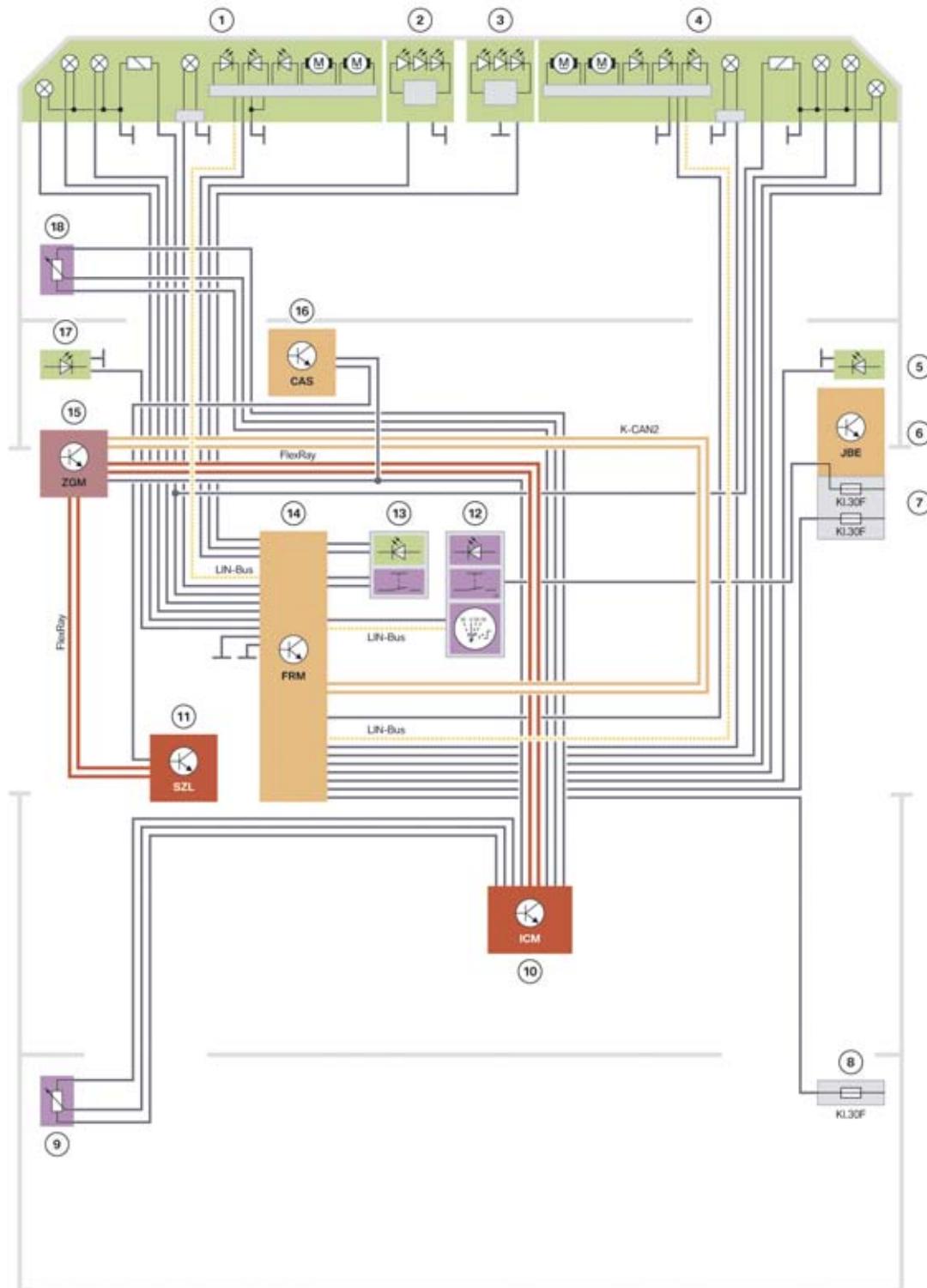
The fog light has been implemented in LED technology for the first time in the F12.

For more information on exterior lights, refer to the "F01/F02 Exterior lights" training material available on TIS and ICP.

F12 General Vehicle Electronics

9. Exterior lights

9.1. System wiring diagram



F12 System wiring diagram, exterior lights at front

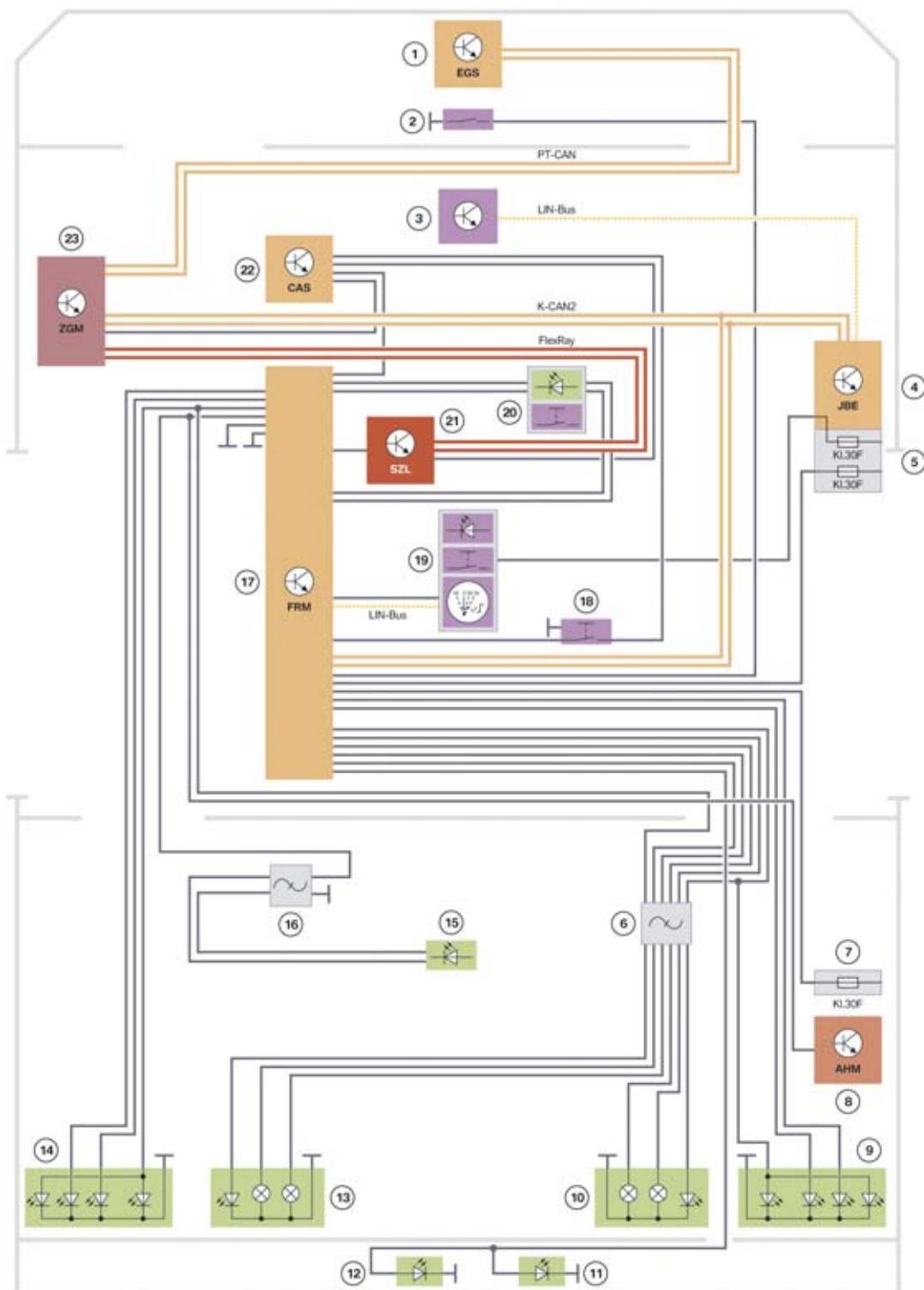
F12 General Vehicle Electronics

9. Exterior lights

Index	Explanation
1	Left headlight (cornering light, second stepper motor, positioning light and position sensor only required)
2	Left fog light
3	Right fog light
4	Right headlight (cornering light, second stepper motor, positioning light and position sensor only required)
5	Side repeater, right
6	Junction box electronics
7	Junction box for the power distribution box
8	Luggage compartment power distribution box
9	Ride height sensor, rear
10	Integrated Chassis Management (ICM)
11	Steering column switch cluster (SZL)
12	Operating facility, light switch
13	Central locking button/hazard warning switch
14	Footwell module (FRM)
15	Central gateway module (ZGM)
16	Car Access System (CAS)
17	Side repeater, left
18	Ride height sensor, front
Terminal 30F	Terminal 30, fault-dependent
LIN-Bus	Local interconnect network bus

F12 General Vehicle Electronics

9. Exterior lights



F12 System wiring diagram, exterior lights at rear

TE10-1344

F12 General Vehicle Electronics

9. Exterior lights

Index	Explanation
1	Electronic transmission control (EGS)
2	Reversing light switch (only with manual gearbox)
3	Rain-light-solar-condensation sensor
4	Junction box electronics
5	Junction box for the power distribution box
6	Interference suppression filter
7	Luggage compartment power distribution box
8	Trailer module (not US)
9	Outer rear light, right
10	Inner rear light, right (in trunk; rear fog light only available with European version)
11	Number plate light on right (in rear bumper)
12	Number plate light on left (in rear bumper)
13	Inner rear light, left (in trunk; rear fog light only available with European version)
14	Outer rear light, left
15	Additional brake light
16	Interference suppression filter
17	Footwell module (FRM)
18	Brake light switch
19	Operating facility, light switch
20	Central locking button/hazard warning switch
21	Steering column switch cluster (SZL)
22	Car Access System (CAS)
23	Central gateway module (ZGM)
Terminal 30F	Terminal 30, fault-dependent
LIN-Bus	Local interconnect network bus

9.2. Lighting, front

The following graphic shows the layout of the front headlight.

F12 General Vehicle Electronics

9. Exterior lights



F12 Front headlight

TE10-1559

Index	Explanation
1	Corona ring with light-emitting diode for parking lights/daytime driving lights
2	Cornering light
3	Side lights, positioning light
4	Xenon light for low and high-beam headlight
5	Corona ring with light-emitting diode for parking lights/daytime driving lights
6	Fog light (light-emitting diodes)
7	Turn indicator



Note: The F12 corona rings have two modes of operation, parking lights at 10% of their full intensity and daytime running lights at 100%.

F12 General Vehicle Electronics

9. Exterior lights

9.3. Lighting, rear

The F12 features a two-part rear light. The layout of the rear lights is shown in the following graphic.



F12 Rear light

Index	Explanation
1	Turn indicator (light-emitting diode)
2	Reversing light
3	Brake light for Brake Force Display
4	Tail light (light-emitting diode)
5	Brake light (light-emitting diode)
6	Tail light/side marker light (light-emitting diode)

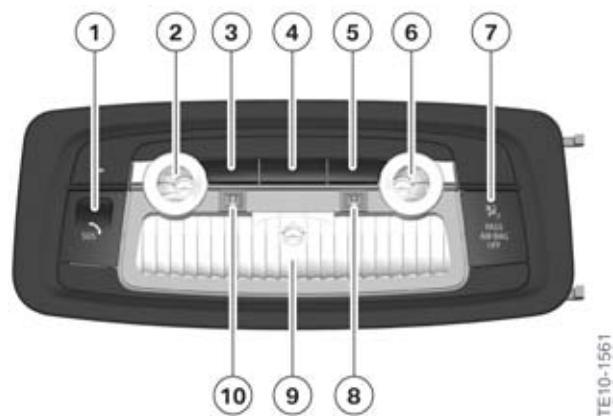
F12 General Vehicle Electronics

10. Interior light

The interior lighting of the F12 is controlled via the footwell module (FRM) control unit.

The footwell module is the central control unit for the interior lighting system. All interior light outputs of the footwell module are pulse-width-modulated. This ensures that the brightness of the interior lighting remains uniform in the event of voltage fluctuations. The pulse width modulation is also used for the soft ON/soft OFF function.

The components of the interior light in the front roof area are integrated in the roof function center (FZD) and in the sun visors. The footwell lighting is located on the underside of the dashboard. Voltage is supplied to the rear reading and passenger-compartment lights via the roof function center.



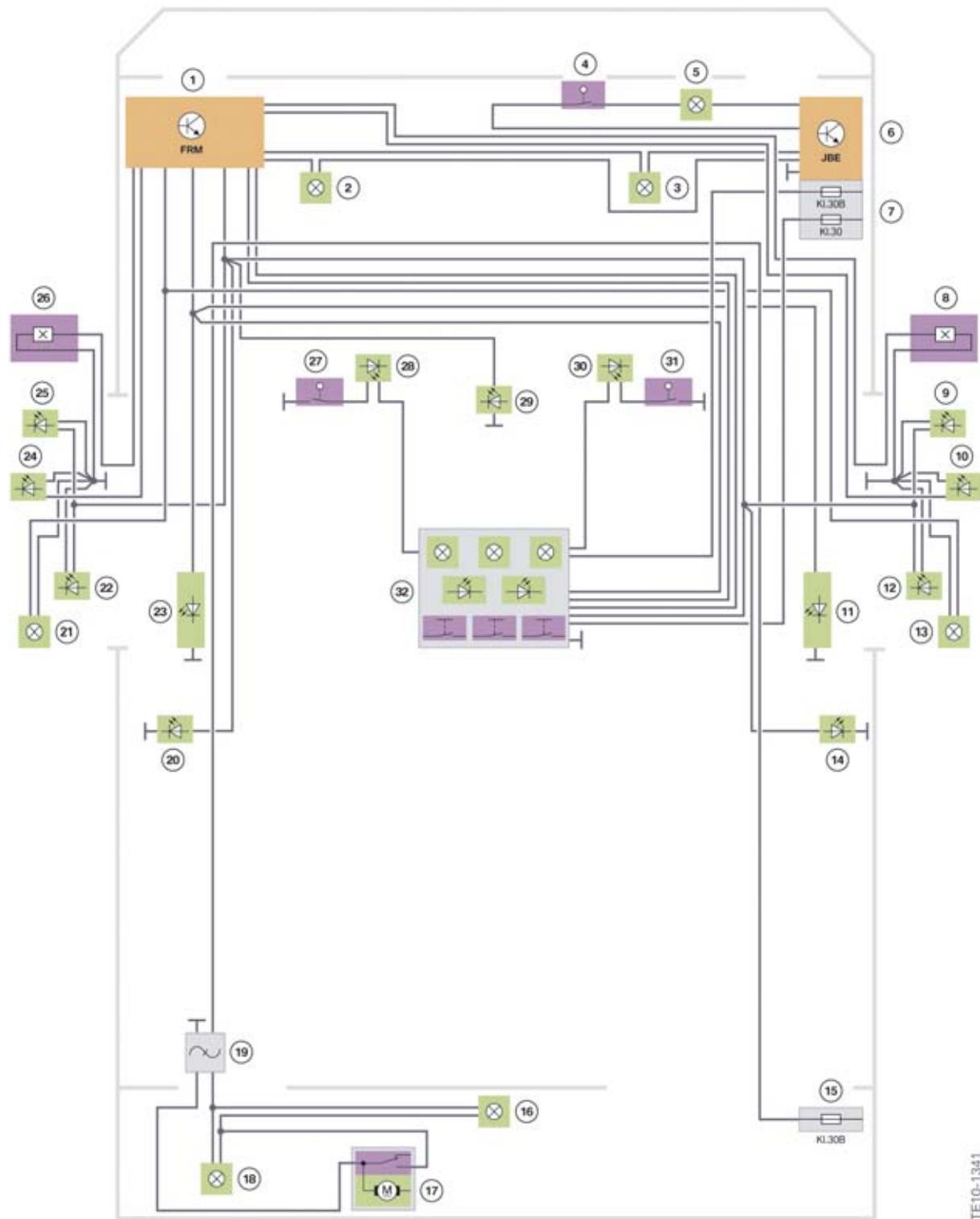
F12 Roof Function Center (FZD)

Index	Explanation
1	Emergency call button
2	Reading light on left
3	Button for reading light on left
4	Button for interior light
5	Button for reading light on right
6	Reading light, right
7	Indicator lamp for front passenger airbag deactivation
8	Ambient lighting
9	Interior light
10	Ambient lighting

F12 General Vehicle Electronics

10. Interior light

10.1. System wiring diagram



F12 System wiring diagram, interior light

TE10-134

F12 General Vehicle Electronics

10. Interior light

Index	Explanation
1	Footwell module (FRM)
2	Footwell light, driver's side at front
3	Footwell light, front passenger side at front
4	Glove box switch
5	Glove box light
6	Junction box electronics (JBE)
7	Junction box for the power distribution box
8	Door contact, front passenger side
9	Inside door handle light, front passenger side
10	Ground lights, front passenger side
11	Entrance lighting, front passenger side
12	Door pocket lighting, front passenger side
13	Door entry lighting, front passenger side
14	Side trim panel lighting, front passenger side at rear
15	Luggage compartment power distribution box
16	Luggage compartment light
17	Trunk lid contact with trunk lock
18	Trunk lid light
19	Interference suppression filter
20	Side trim panel lighting, driver's side at rear
21	Door entry lighting, driver's side
22	Door pocket lighting, driver's side
23	Entrance lighting, driver's side
24	Ground lights, driver's side
25	Inside door handle light, driver's side
26	Door contact, driver's side
27	Vanity mirror light switch on driver's side
28	Vanity mirror light on driver's side
29	Center console storage compartment lighting
30	Vanity mirror light on front passenger side
31	Vanity mirror light switch, front passenger side
32	Roof function center (FZD) with interior light unit and reading lights
Terminal 30	Terminal 30
Terminal 30B	Terminal 30, basic operation

F12 General Vehicle Electronics

10. Interior light

10.2. Examples of switching operations

If a door is opened when the vehicle is unlocked, the status of the relevant door contact changes. The footwell module (FRM) evaluates the status and sends the request to switch on the interior light. Parallel to this, the footwell module (FRM) switches on the door entry lighting for the open door, the door entry lighting and footwell lighting.

The status of the door contact changes again when the door is closed. The footwell module initiates the procedure to switch off the interior light.

The luggage compartment lights are connected to the voltage supply via terminal 30B. If the trunk lid is opened, the luggage compartment light and trunk lid light are switched on via the trunk contact.

F12 General Vehicle Electronics

11. Front seats

The following front seat versions are available for the F12:

- Multi-contour seat
- Front ventilated seat
- Active front seat

The following table provides an overview of the available optional equipment (SA).

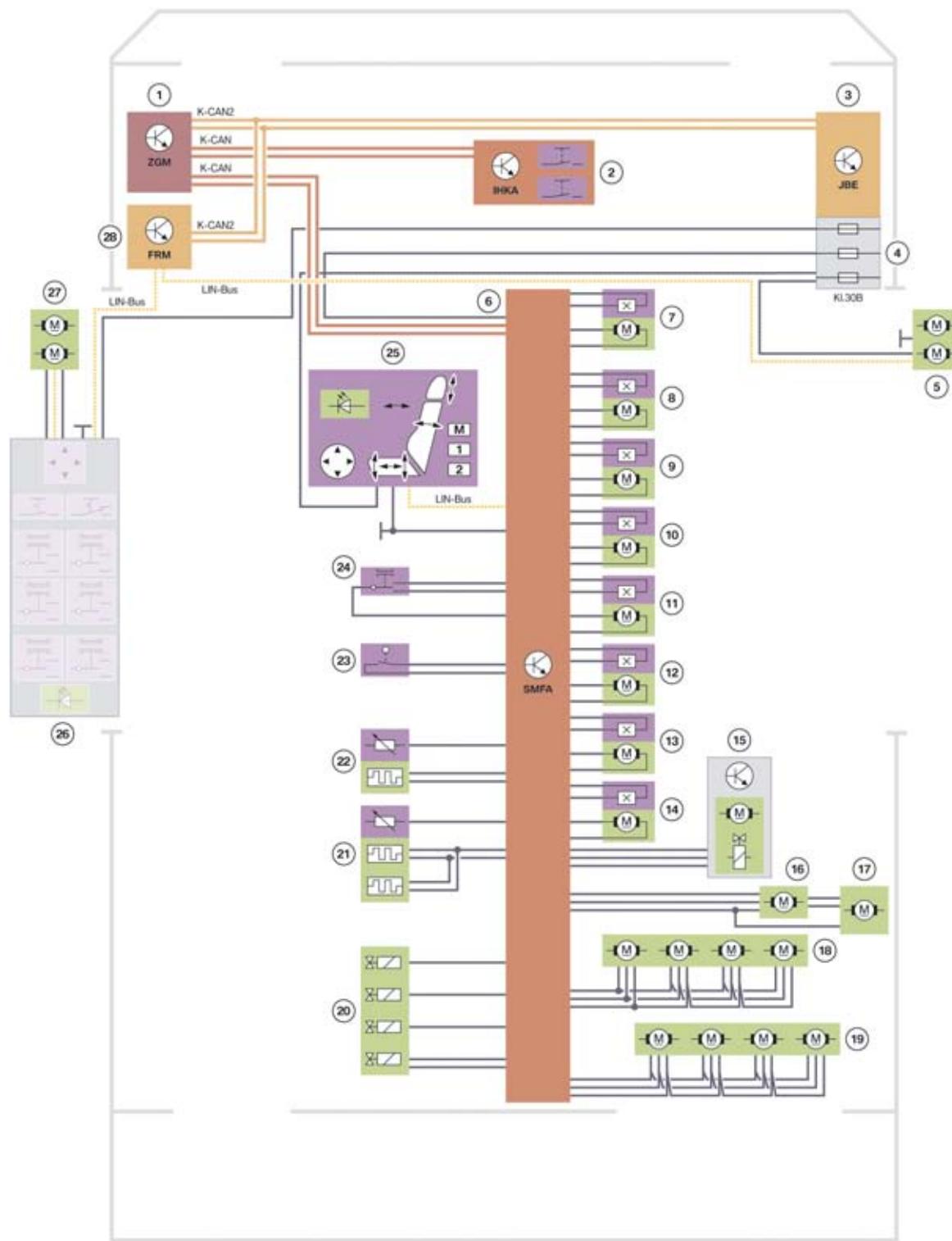
Multi-contour seat	
Seat memory	Standard
Seat heating for driver/front passenger	SA 248 / ZCW package
Lumbar support, driver/front passenger	Standard
Active seat for driver / front passenger	SA 455 / ZLS Luxury seating package
Ventilation seat for driver / front passenger	SA 453 / ZLS Luxury seating package
Crash-active head restraint ¹	Standard
Comfort head restraint	Standard

¹ For more information on the crash-active headrest refer to the "F12 Passive safety system" section of this training material.

F12 General Vehicle Electronics

11. Front seats

11.1. System wiring diagram



F12 System wiring diagram, driver's seat (Multi-contour seat, with Active seat for driver/front passenger, SA 455)

TE10-1450

F12 General Vehicle Electronics

11. Front seats

Index	Explanation
1	Central gateway module (ZGM)
2	Automatic integrated heating and A/C control unit (IHKA)
3	Junction box electronics (JBE)
4	Junction box for the power distribution box
5	Exterior mirror motors, front passenger side
6	Driver's seat module (SMFA)
7	Electric motor, forward/back seat adjustment
8	Electric motor, seat angle adjustment
9	Electric motor, seat height adjustment
10	Electric motor, backrest angle adjustment
11	Motor, head restraint height adjustment
12	Motor, seat depth adjustment
13	Motor, backrest upper section adjustment
14	Motor, backrest width adjustment
15	Lumbar active-seat drive
16	Massage function drive (only with active seat front, SA 455 included with ZLS Luxury Seating Package)
17	Massage function drive (only with active seat front, SA 455 included with ZLS Luxury Seating Package)
18	Fan, seat surface (only with seat ventilation front, SA 453 included with ZLS Luxury Seating Package)
19	Fan, backrest (only with seat ventilation front, SA 453 included with ZLS Luxury Seating Package)
20	Solenoid valves, lumbar-support adjustment
21	Seat heating, backrest (only with seat heating for driver/front passenger, SA 494 included with ZCW Cold Weather Package)
22	Seat heating, seat surface (only with seat heating for driver/front passenger, SA 494 included with ZCW Cold Weather Package)
23	Switch, backrest lock
24	Switch for easy entry
25	Switch block, seat adjustment
26	Switch block, driver's door
27	Exterior mirror motors, driver's side
28	Footwell module (FRM)
Terminal 30B	Terminal 30, basic operation
LIN-Bus	Local interconnect network bus

F12 General Vehicle Electronics

11. Front seats

11.2. Seat adjustment

The seats of the F12 can be adjusted backwards or forwards in nine directions with the maximum equipment specification.



TK10-1541

F12 Maximum seat adjustment

Index	Explanation
1	Head restraint height adjustment
2	Backrest upper section adjustment
3	Backrest angle adjustment
4	Backrest width adjustment
5	Forward/back seat adjustment

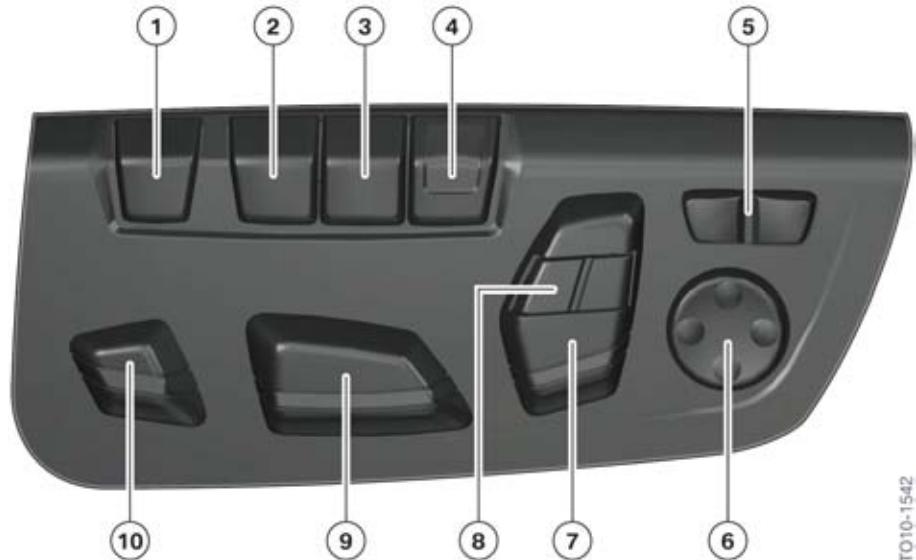
F12 General Vehicle Electronics

11. Front seats

Index	Explanation
6	Seat height adjustment
7	Seat angle adjustment
8	Seat depth adjustment
9	Lumbar-support adjustment

Seat adjustment options	Multi-contour seat
Seat height adjustment	electric
Forward/back seat adjustment	electric
Seat angle adjustment	electric
Backrest angle adjustment	electric
Head restraint height adjustment	electric
Seat depth adjustment	electric
Backrest width adjustment	electric
Backrest upper section adjustment ¹	electric
Lumbar-support adjustment	electric

¹ When the backrest upper section in the F12 is adjusted, only the top section moves, and not the entire upper section of the backrest including head restraint (as is the case in the F01).



F12 Seat adjustment, driver (at seat), electrical Comfort seat

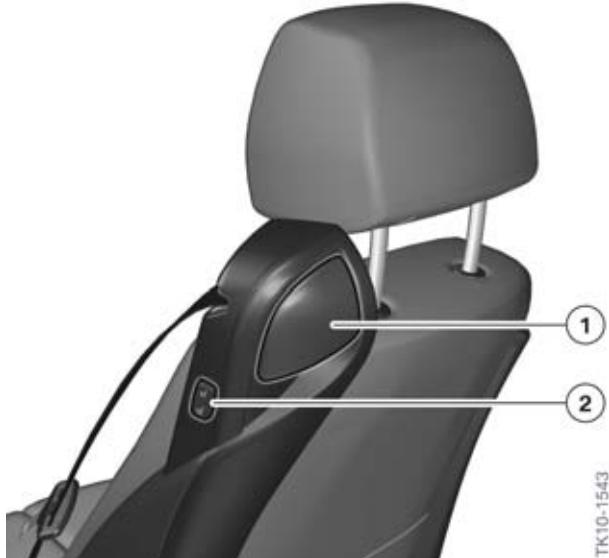
F12 General Vehicle Electronics

11. Front seats

Index	Explanation
1	Active seat button
2	Button 2 (calls up stored position)
3	Button 1 (calls up stored position)
4	Button M (stores current position)
5	Backrest width adjustment
6	Lumbar-support adjustment
7	Backrest angle and head restraint height adjustment
8	Backrest upper section adjustment
9	Forward / back, seat height and seat angle adjustment
10	Seat depth adjustment

A seat adjustment with top-mounted memory buttons features for the first time in the F12, which means they are also visible to the occupants when seated.

The front seats feature a rear easy-entry facility via the forward/back seat adjustment and a backrest forwards-folding mechanism.



F12 Rear easy-entry facility

Index	Explanation
1	Handle, backrest forwards-folding mechanism
2	Button, rear easy-entry facility



Fold the backrest back and lock it before driving off, as otherwise there is danger of the seat moving unexpectedly.

F12 General Vehicle Electronics

11. Front seats

In contrast to the E63, the handle for the backrest forwards-folding mechanism is located directly on the reversing mechanism. It no longer needs to be operated in order to fold back the backrest.

Depending on the seat position, the seat and/or head restraint move downwards when the backrest is folded forwards.

If the backrest does not engage correctly after it has been folded back, a Check Control message is displayed in the instrument panel (KOMBI).

The seat can be moved into the required position by pressing the rear easy-entry facility button. The movement stops when the button is released. If the seat is adjusted backwards, it moves into its original position.

If the rear easy-entry facility button is only briefly pressed, the seat moves into the corresponding end position. The movement can be stopped by pressing the button again.

11.3. Seat heating

The buttons for the operation of the seat heating are in the IHKA control panel.



F12 IHKA control panel

Index	Explanation
1	Button for seat heating, driver seat
2	Button for seat heating, front passenger seat

11.4. Active seat ventilation

The buttons for the operation of the active seat ventilation are in the IHKA control panel.

F12 General Vehicle Electronics

11. Front seats



TE07-1824

F12 IHKA control box

Index	Explanation
1	Button for active seat ventilation on driver seat
2	Button for active seat ventilation on front passenger seat

11.5. Side head airbag



TE10-1495

F12 Side head airbag

Index	Explanation
1	Side head airbag

The side head airbag is not under the seat cover and instead is mounted as a container solution laterally on the seat frame.

F12 General Vehicle Electronics

11. Front seats

11.6. Seat belt

Front seats with an integrated seat belt system are used in the F12, which makes the seat belt considerably easier to reach.



TE10-1497

F12 Seat belt

Index	Explanation
1	Seat belt buckle tensioner
2	Side head airbag
3	Automatic tensioner with adaptive force limiter

The inertia reel is located below the seat pan of the front seat which means the rear seat passengers have more knee room than in the E64 and also reduces the weight of the backrest.

The front seats are equipped with seat occupancy detection and belt tensioners.

F12 General Vehicle Electronics

12. Heating and air conditioning systems

The 2/2-zone automatic integrated heating and A/C control unit IHKA is installed in the F12.

The first number denotes the number of controllable temperature zones (temperature selector wheels) and the second denotes the number of controllable air volume and air distribution zones (separate fan settings).



TG10-1674

F12 IHKA control panel

12.1. Equipment

- Separate temperature control, front left/right
- Separate control of amount and distribution of air for front left and right
- Convertible mode with open soft top
- Independent ventilation
- Residual heat utilization
- Anti-fogging
- Fresh air and recirculated air filtering (microfilter)
- Individual automatic control with five intensity levels
- Solar compensation¹
- Automatic air recirculation control (including combination filter²)
- ALL function (driver's settings are transferred to front passenger).

¹ A solar sensor detects external light/heat sources that affect the interior climate.

² Combination microfilter is used to trap dust and pollen while a carbon element stops unpleasant odors.



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